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THE ELEMENTS

OF

GRAPHICAL STATICS

AND THEIR APPLICATION TO

FRAMED STRUCTURES,

WITH NUMEROUS PRACTICAL EXAMPLES OF

CRANES—BRIDGE, ROOF AND SUSPENSION TRUSSES—BRACED AND STONE ARCHES—PIVOT AND DRAW SPANS—CONTINUOUS GIRDERS, &c.,

TOGETHER WITH THE BEST

METHODS OF CALCULATION,

AND CONTAINING ALSO

NEW AND PRACTICAL FORMULÆ

FOR THE

Pivot or Draw Span—Braced Arch—Continuous Girder, Etc.

BY

A. JAY DU BOIS, C.E., Ph.D.

PROFESSOR OF CIVIL AND MECHANICAL ENGINEERING, LEHIGH UNIVERSITY, PENNA.

"Peu à peu les connaissances alegébriques déviendront moins indispensables, et la science, reduite à ce qu'elle doit être, à ce qu'elle devrait être déjà, sera ainsi mise à la portée de cette classe d'hommes, qui n'a que des moments fort rares à y consacrer." [*Poncelet-Traité des propriétés projectives des figures, Paris*, 1828.]

PLATES.

NEW YORK:

JOHN WILEY AND SON,

15 Astor Place.

1875.

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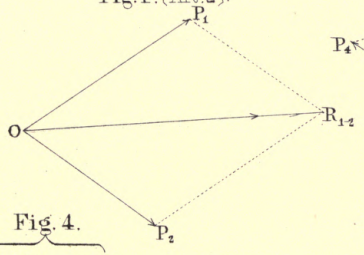
Fig. 1. (Art. 2).



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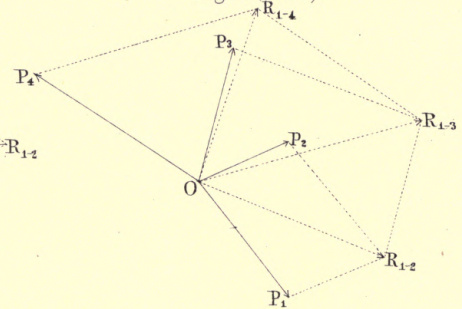
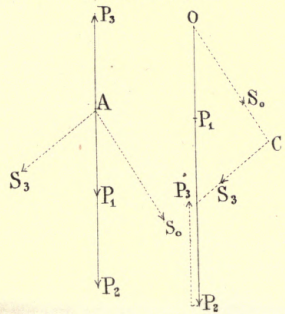


Fig. 4.

(a) (Art. 7). (b)



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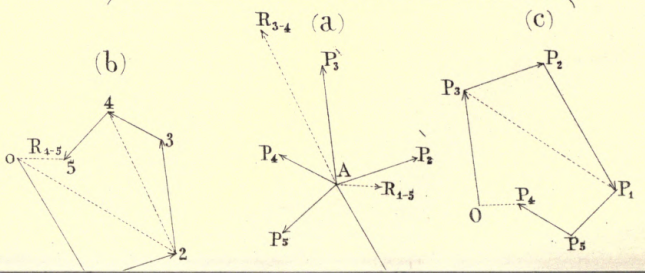

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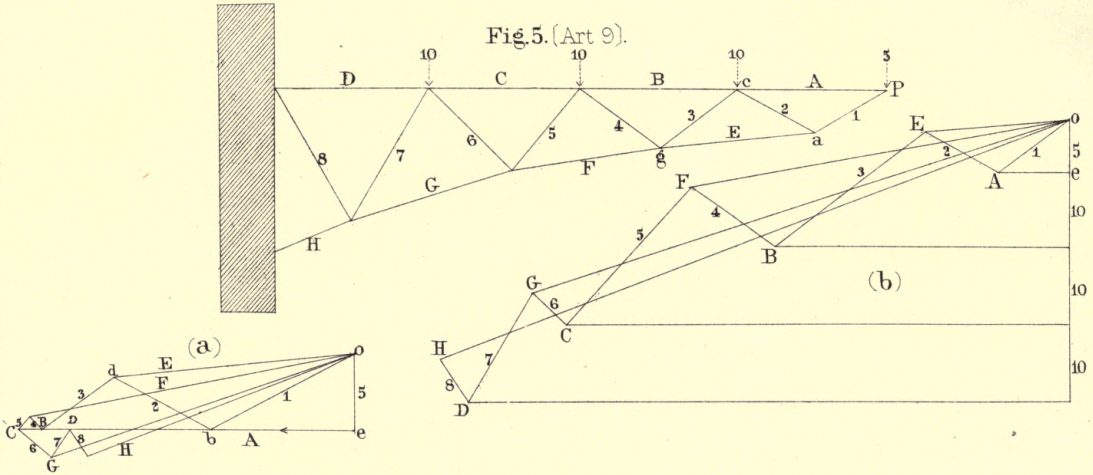
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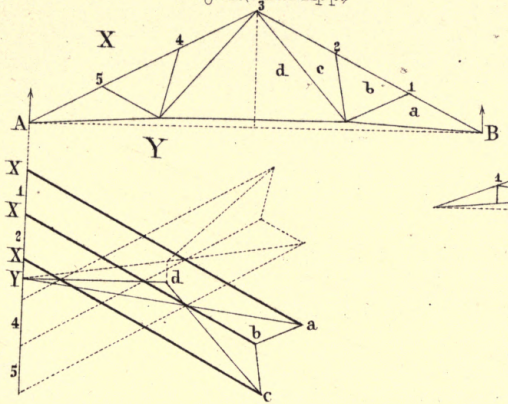
Fig. II. (Art. 5. App.)



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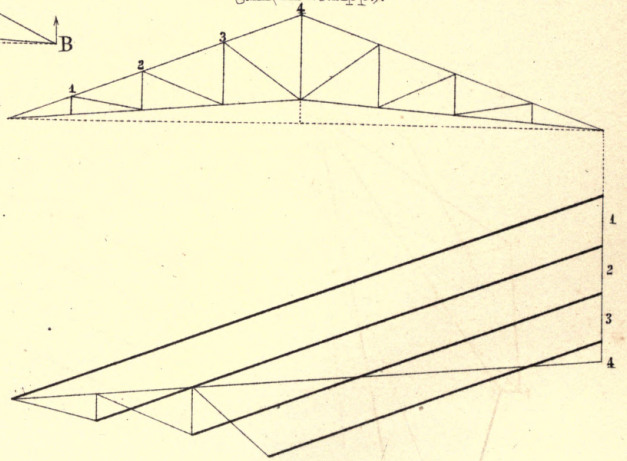

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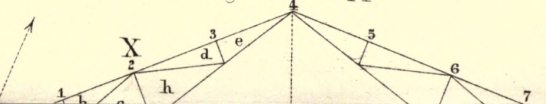

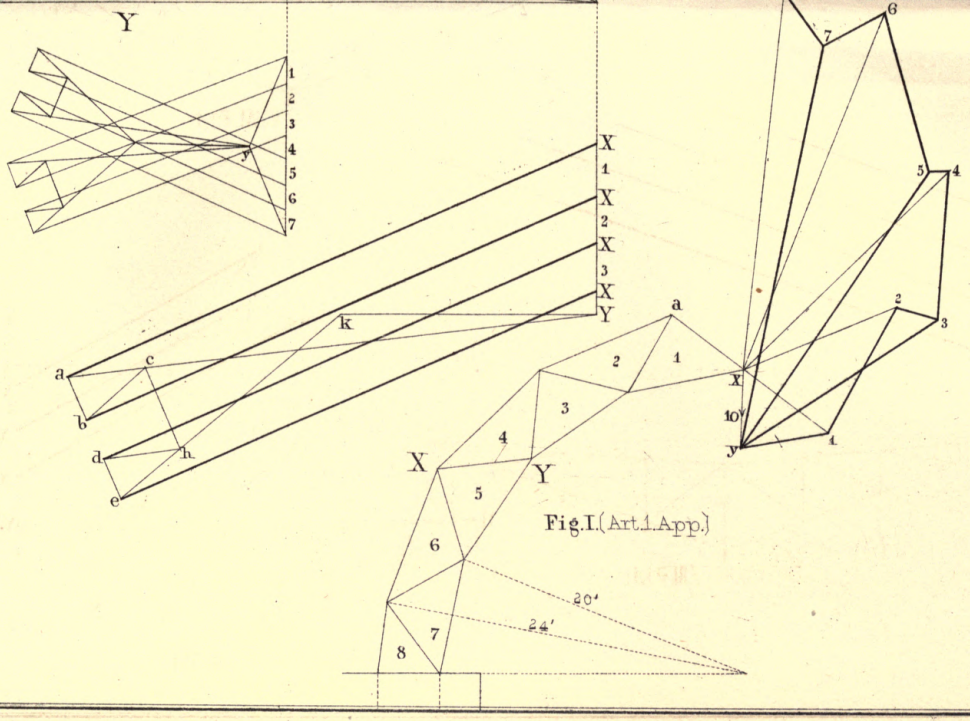

Fig. I. (Art. 1. App.)

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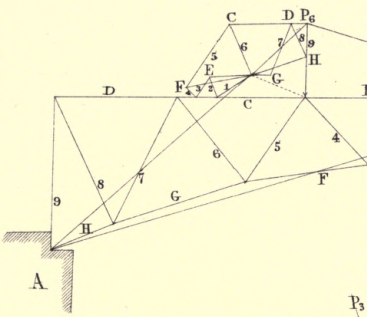
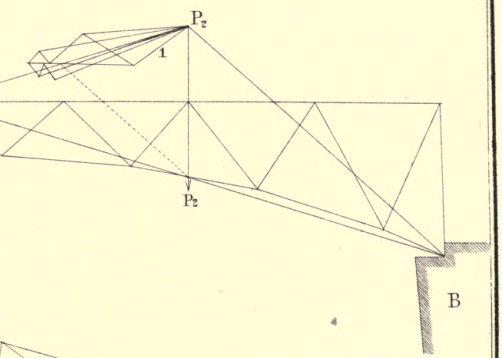


Fig. 5 (c). (Art. 13).



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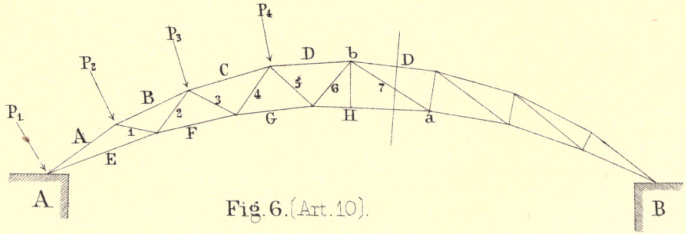

Fig. 6. (Art. 10).

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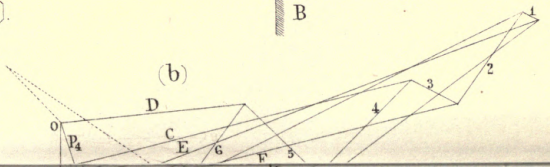

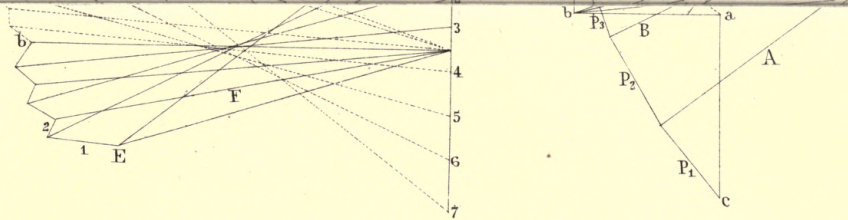
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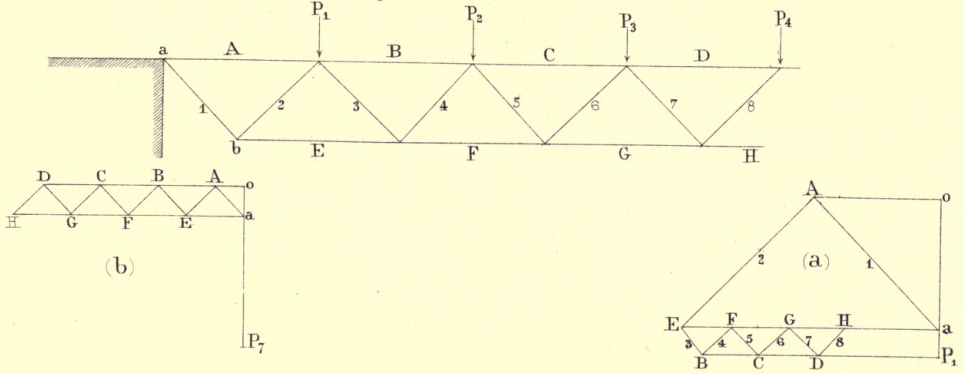
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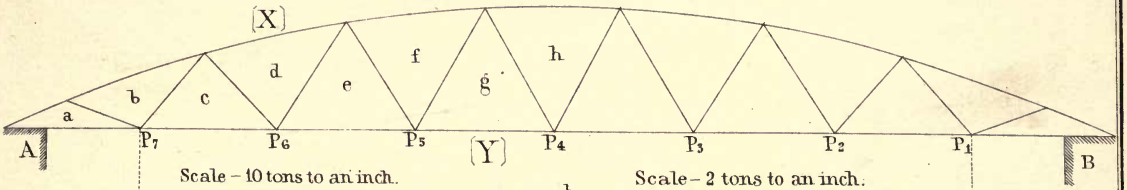
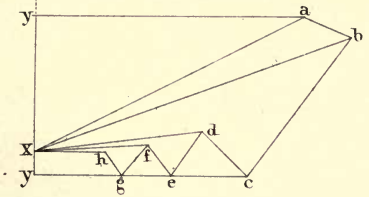
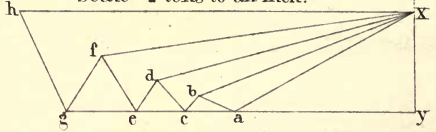
Fig.V.(Art.7. App.)



Scale – 10 tons to an inch.



Scale – 2 tons to an inch.



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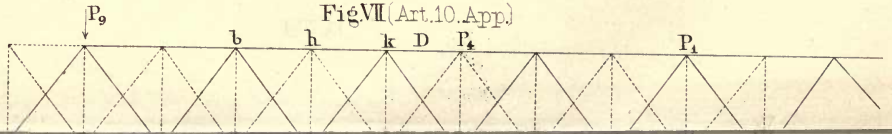
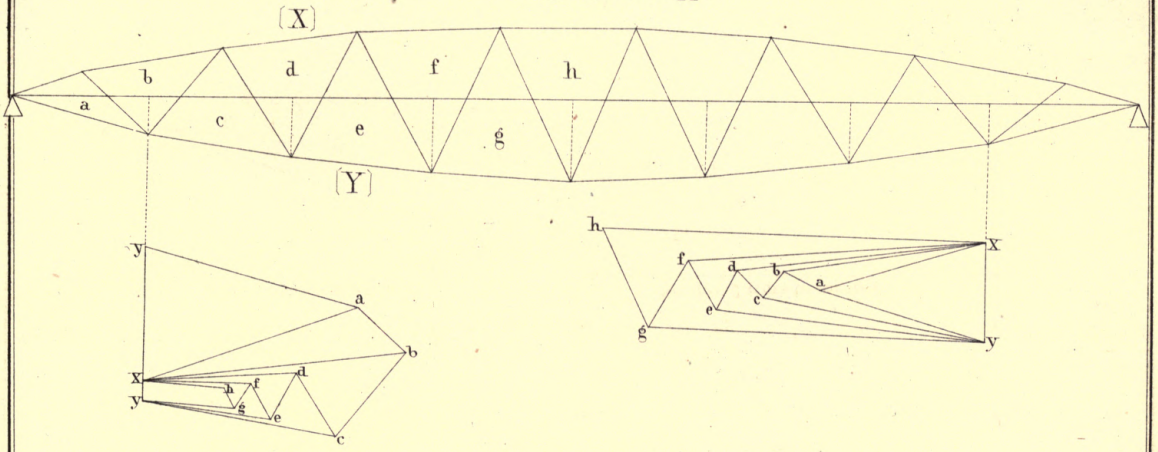
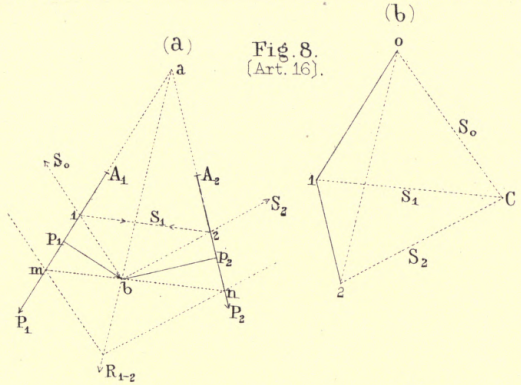


Fig. VI. (Art. 9. App.)





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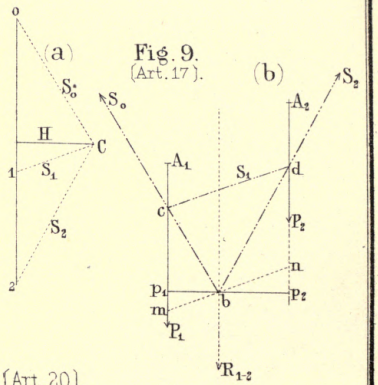
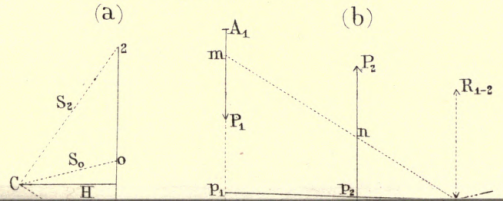


Fig. 9. (Art. 17).

Fig. 10. (Art. 17).



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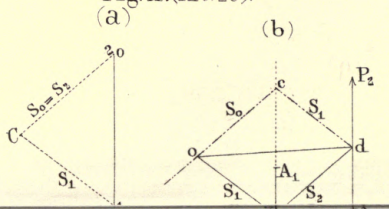


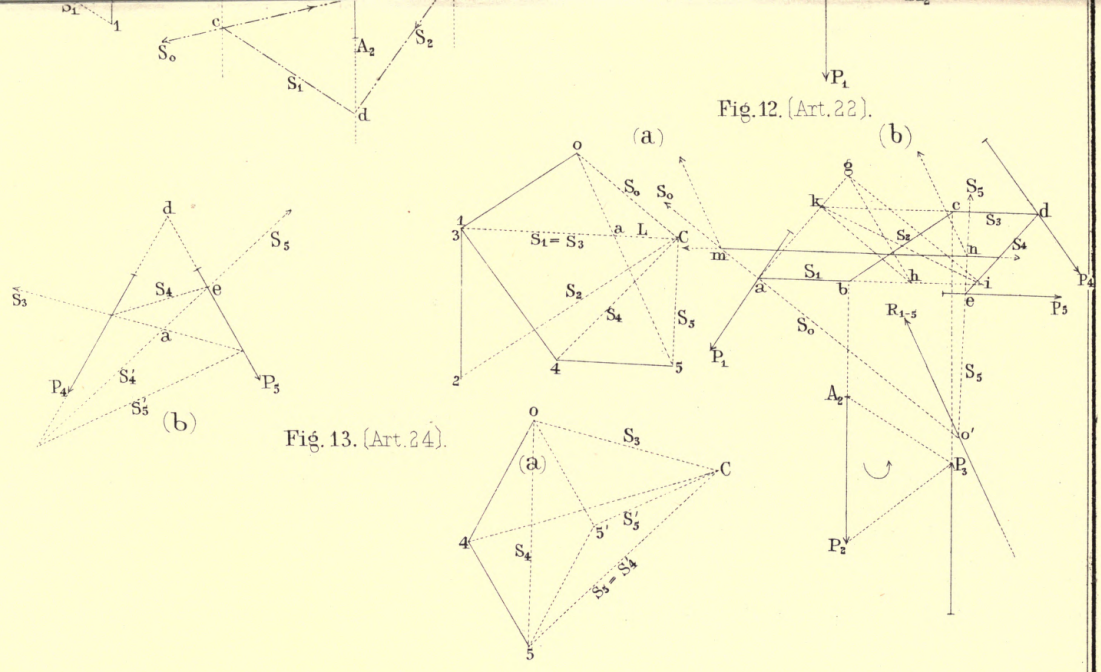
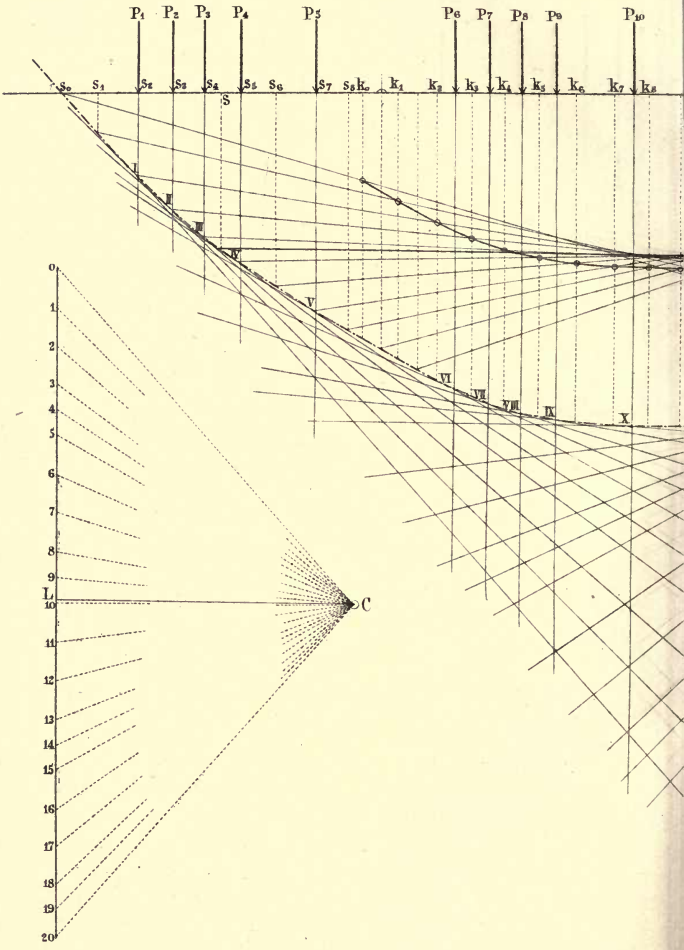


Fig. 12. (Art. 22).

Fig. 13. (Art. 24).

Fig
(Art. 15.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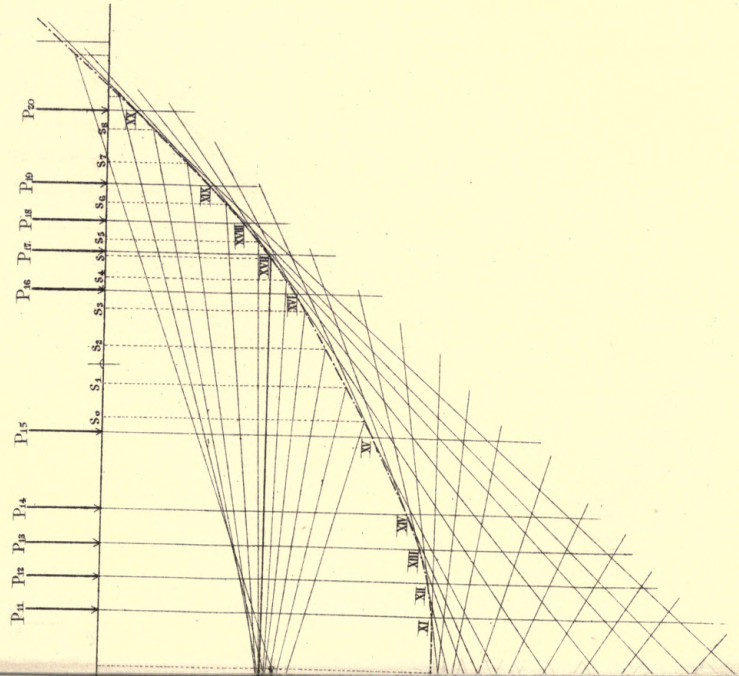
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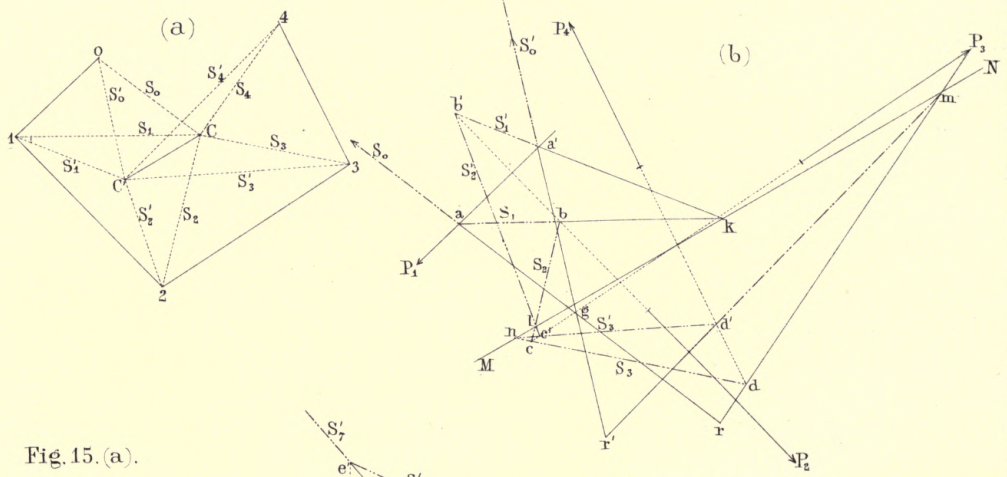
Fig. 14. (Art. 26).



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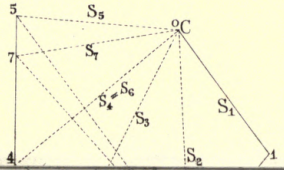

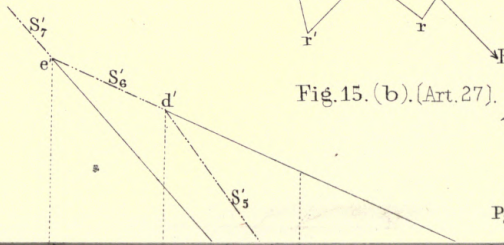

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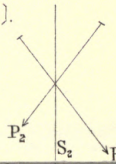

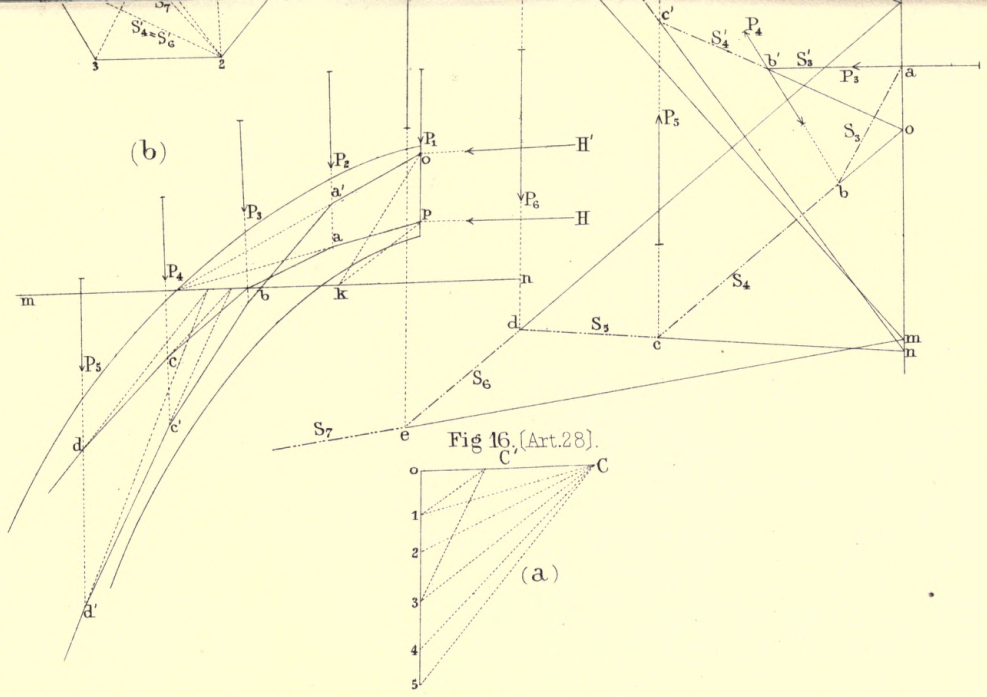
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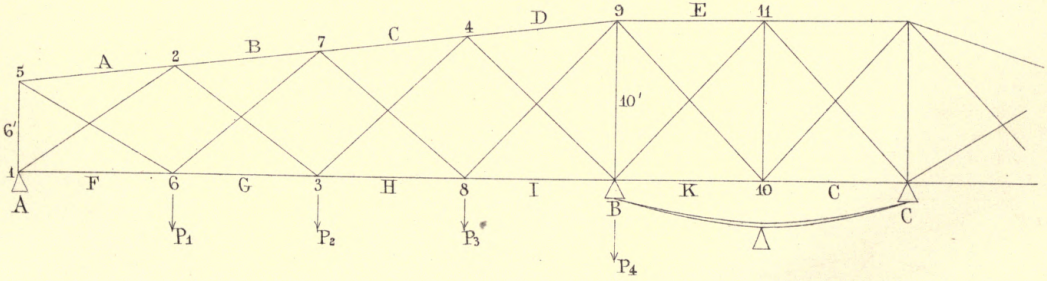
Fig 16. [Art. 28].

Fig. IX. (Art. 16. App.)



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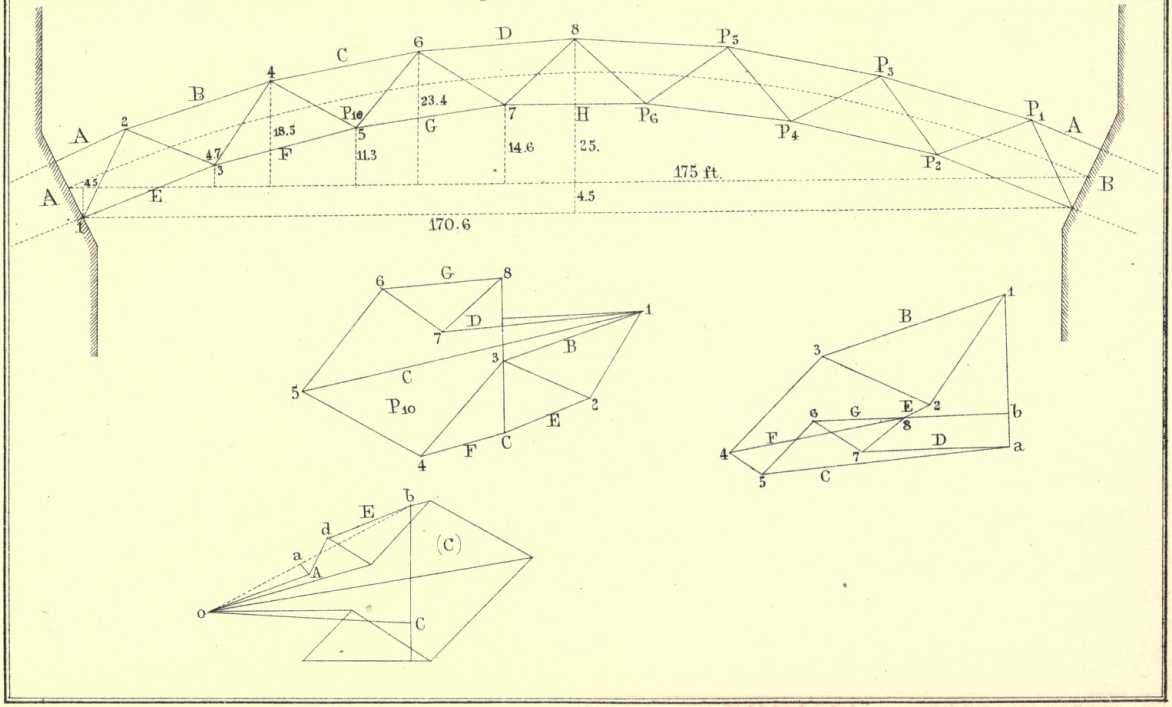

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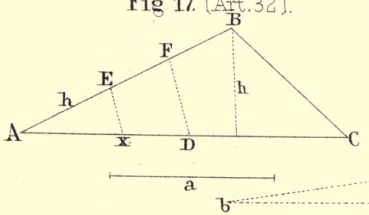

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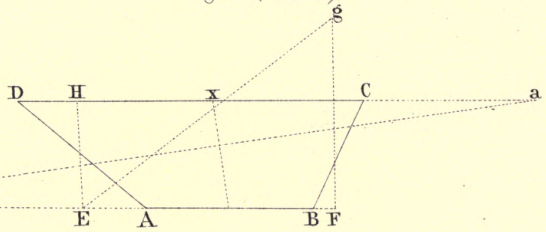

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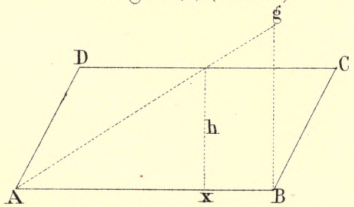

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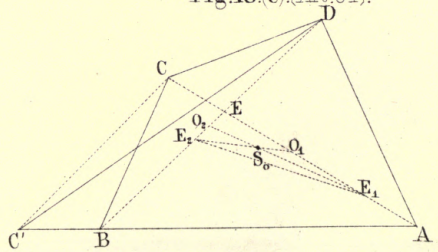

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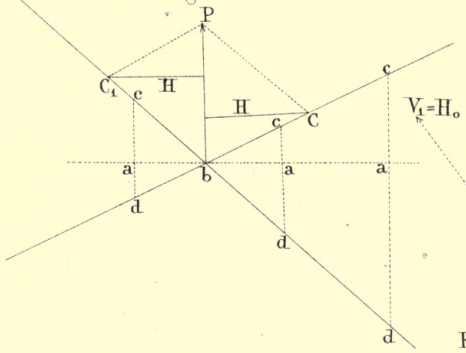

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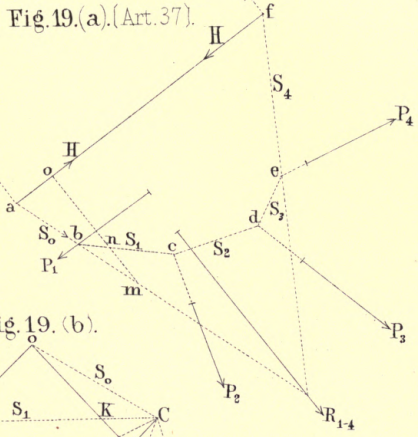
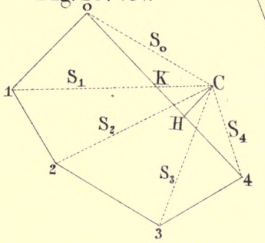
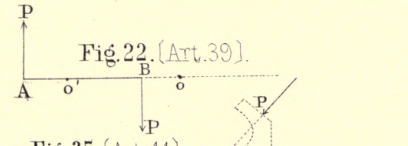


Fig. 19. (b).





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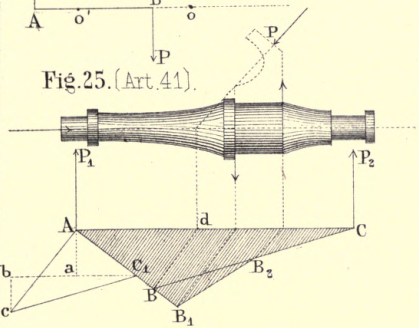

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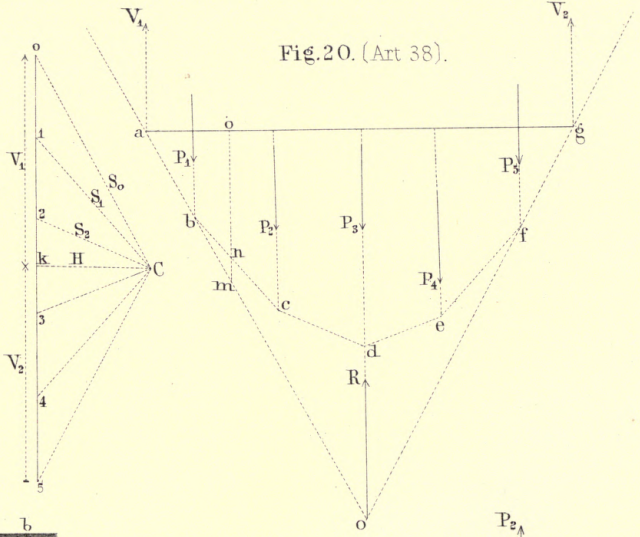

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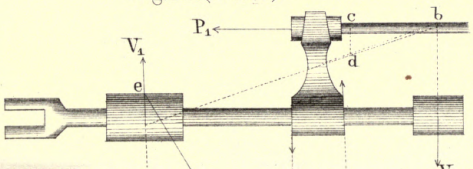

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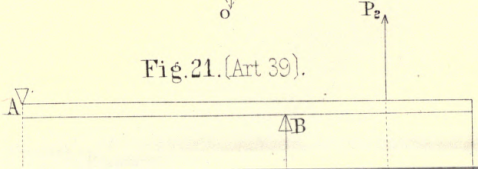
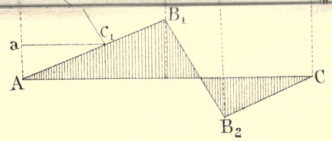


Fig. 21. (Art 39).



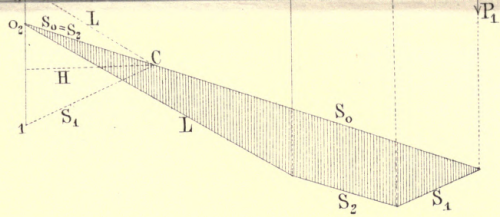


Fig. 23. (Art 39).

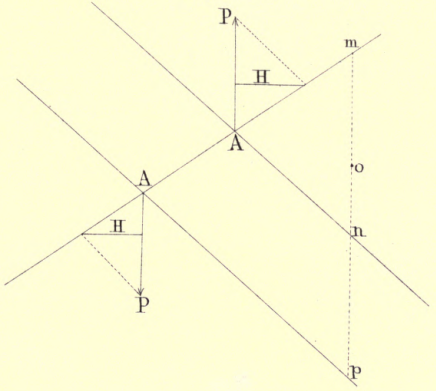


Fig. 24. (Art. 40).

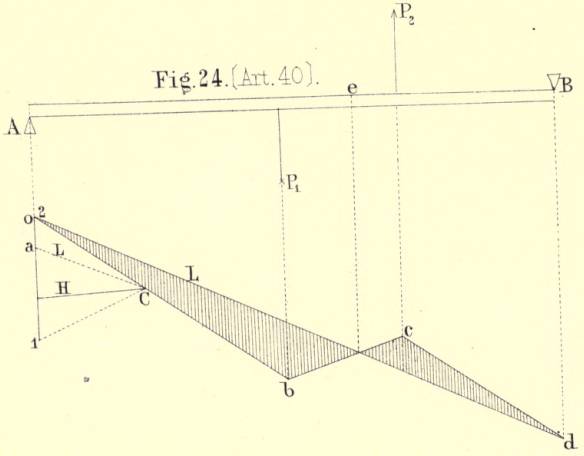
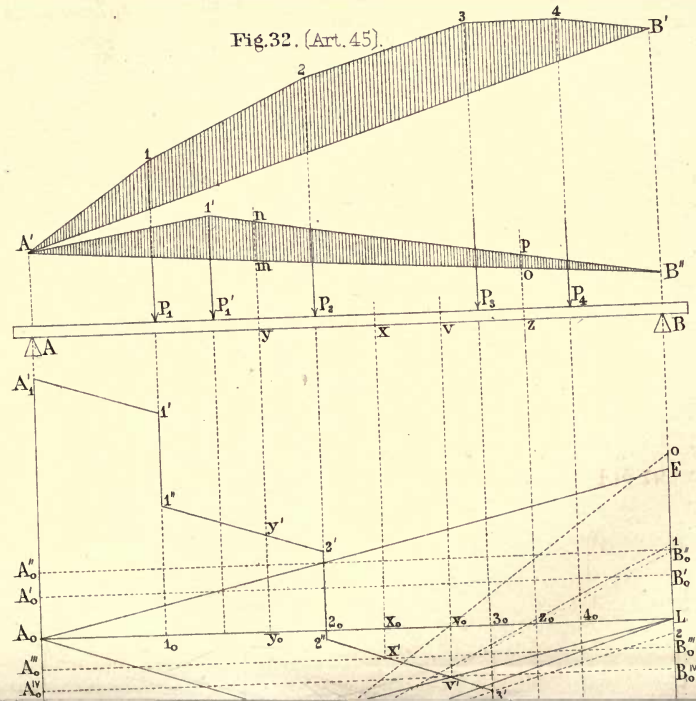


Fig.32. (Art. 45).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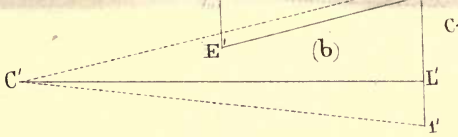


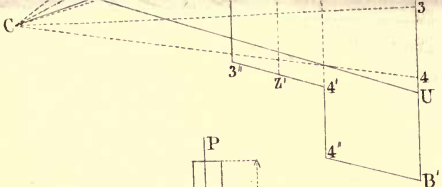


Fig. 27. (Art. 41).

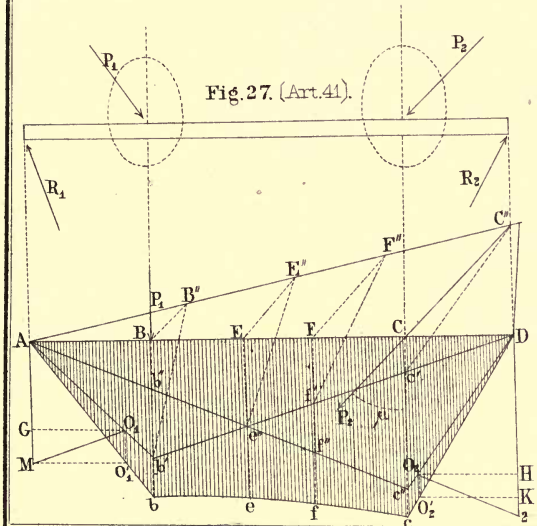


Fig. 28. (Art. 41).

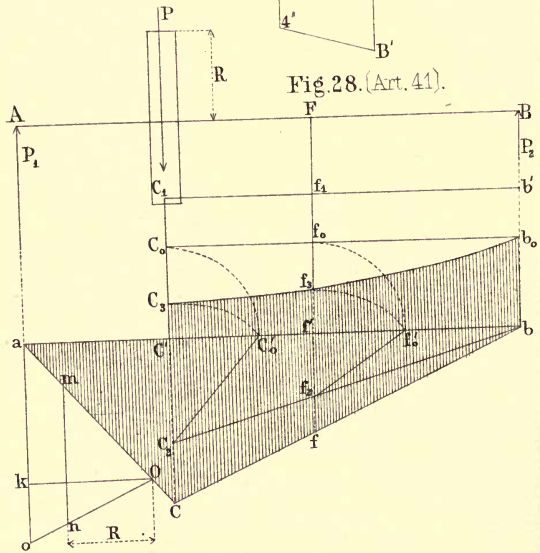
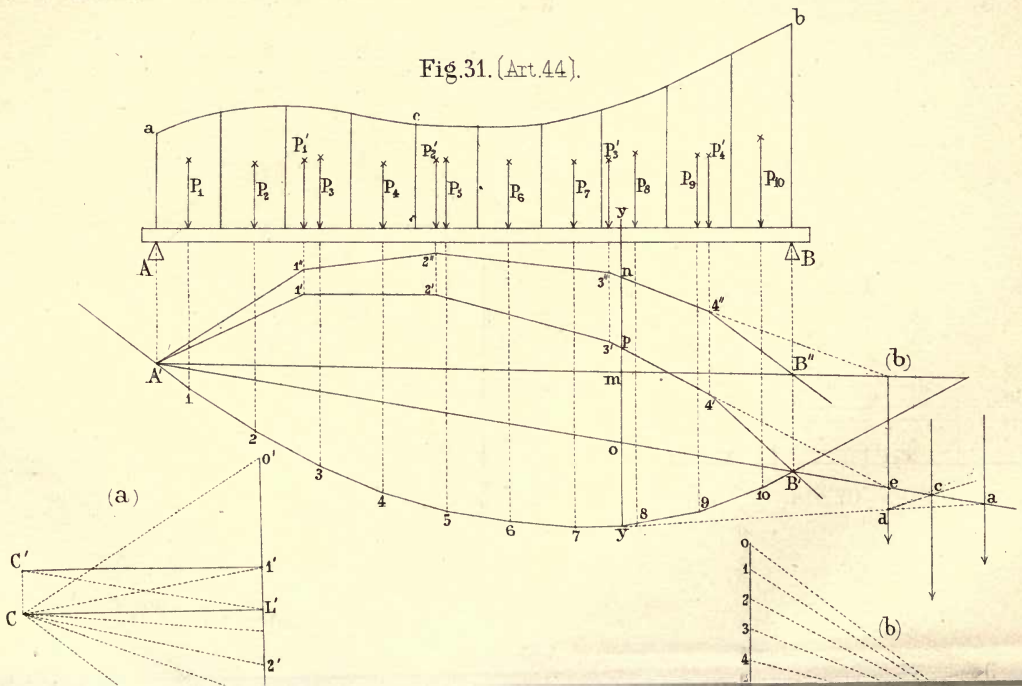


Fig.31. (Art.44).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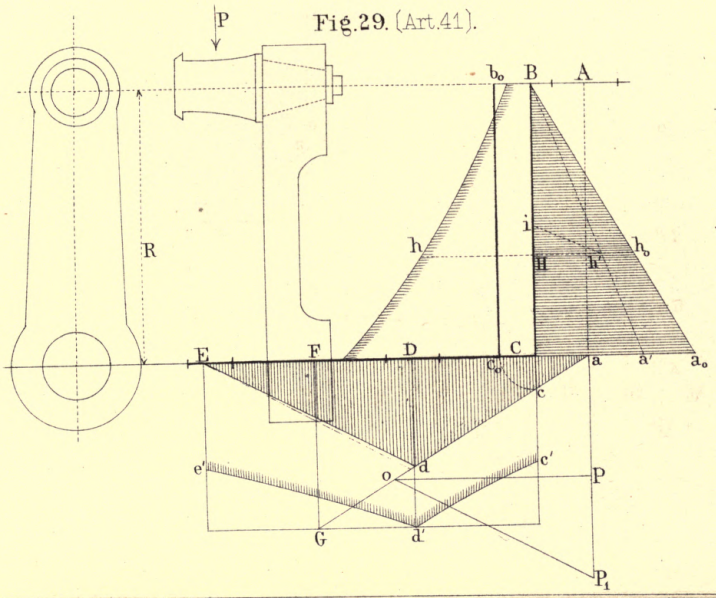


Fig.29. (Art.41).

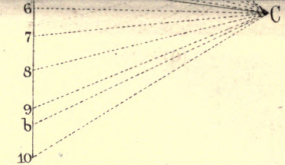


Fig.30. (Art.43).

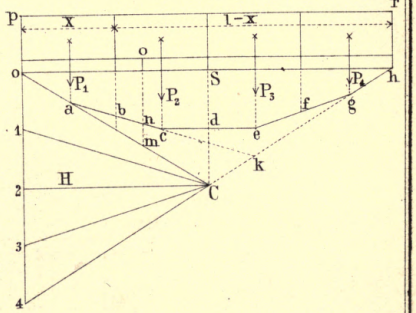
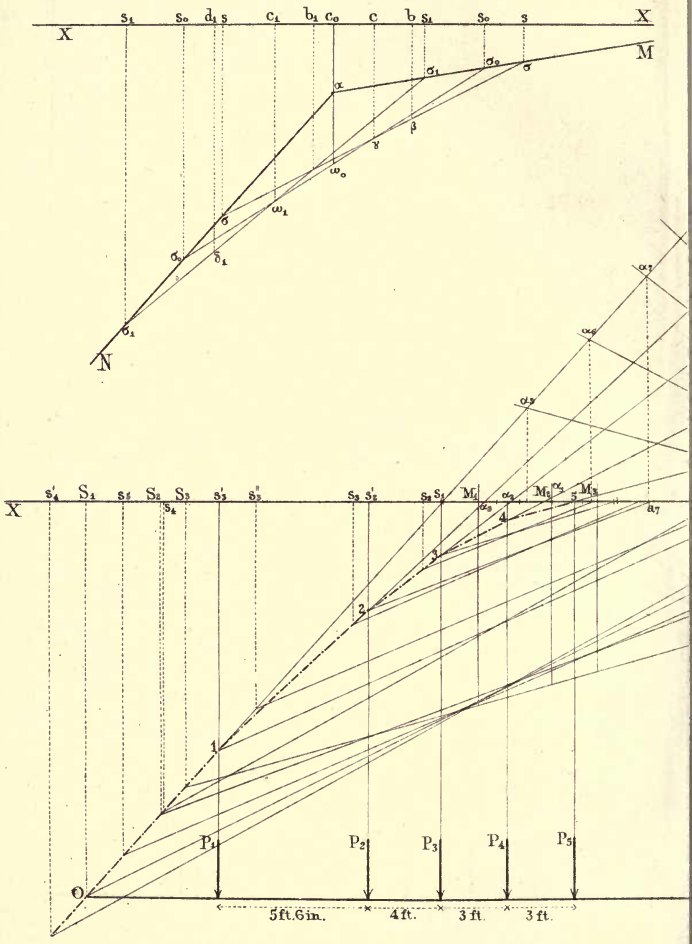


Fig. 32 (d).
(Art. 48.)



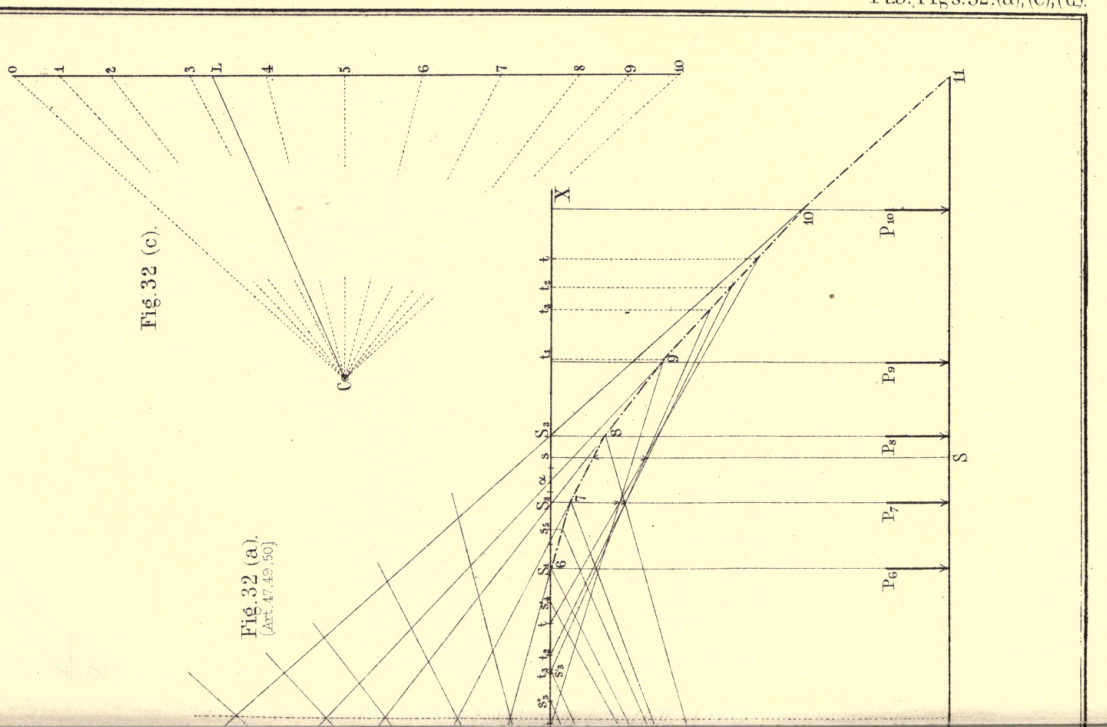


Fig.32 (c).
Fig.32 (a).
(Art. 47 49, 50)
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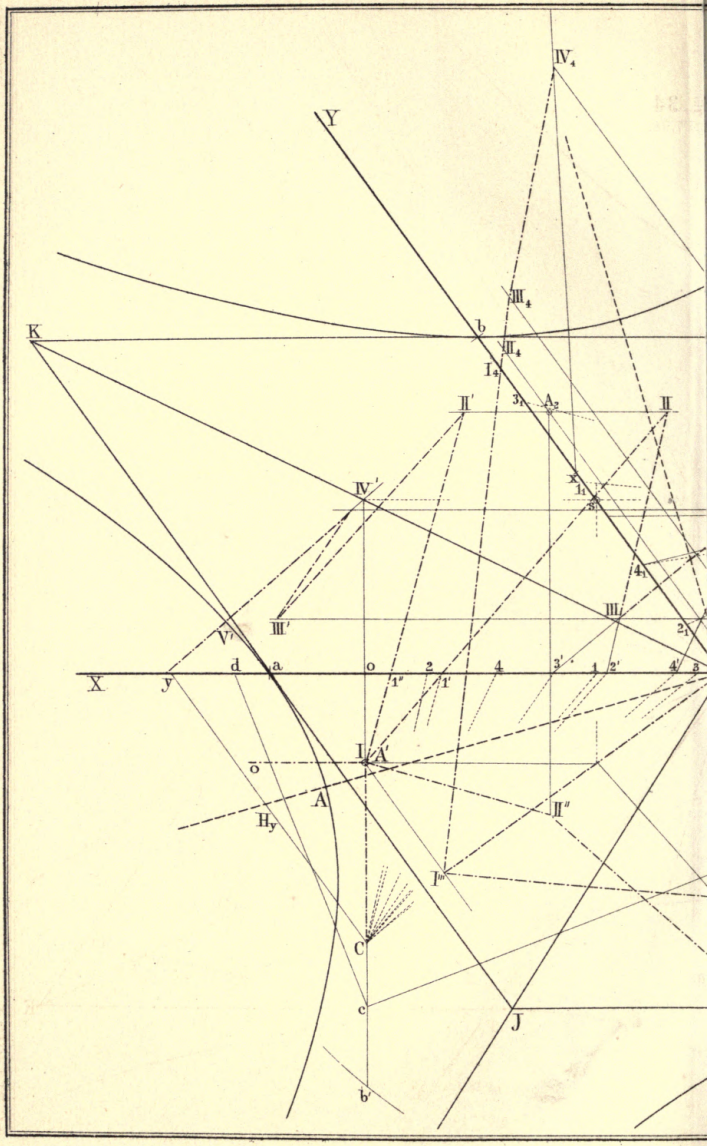
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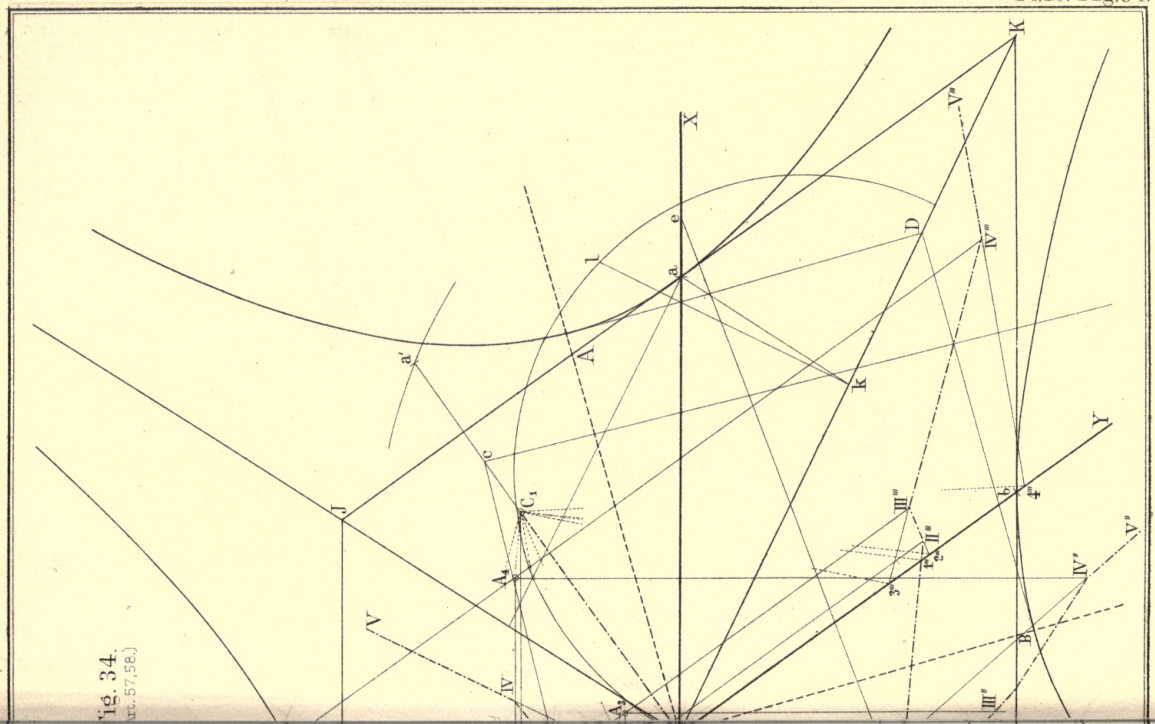
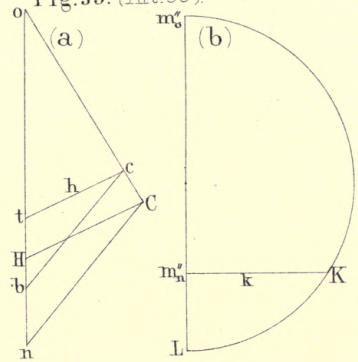


Fig. 34.
(Art. 57,58.)

Fig.33. (Art.55).



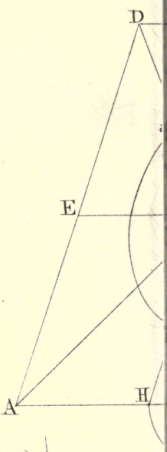


Fig.35. (Art.60).

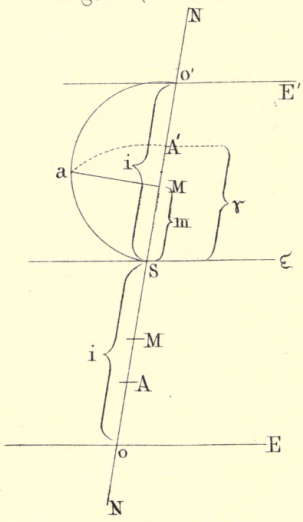
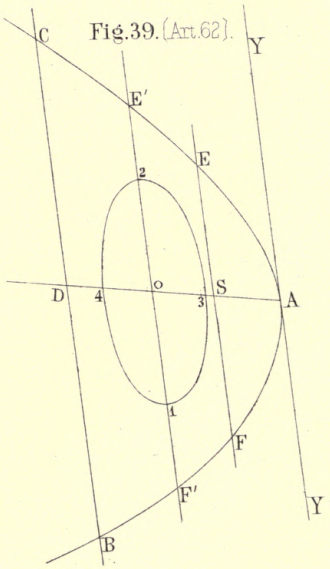


Fig.39. (Art.62).



ig. 36. (Art. 62.).

Fig. 37. (Art. 62).

Fig. 38. (Art. 62).

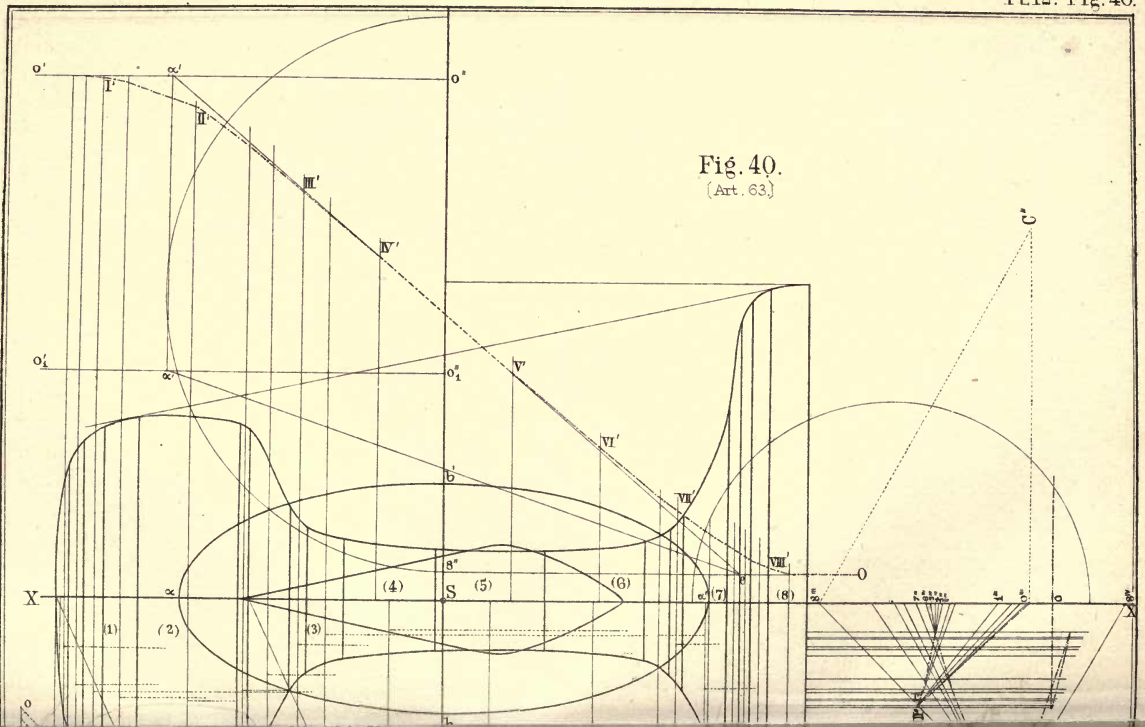
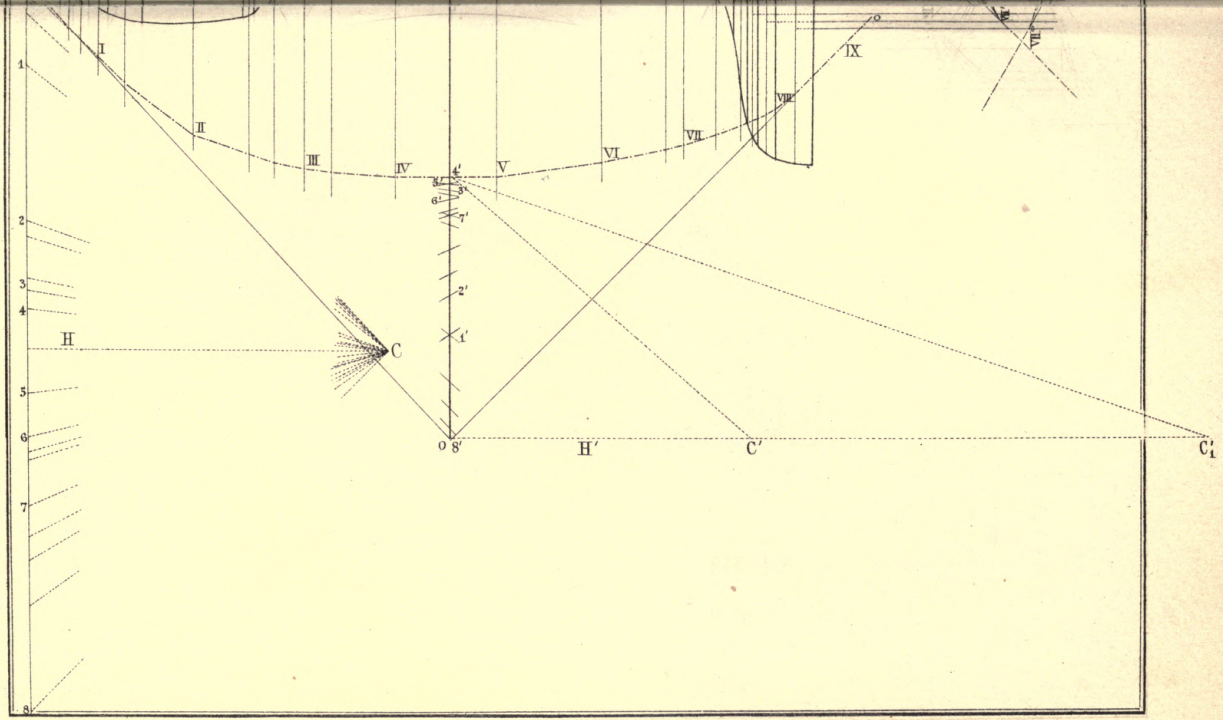


Fig. 40.
(Art. 63.)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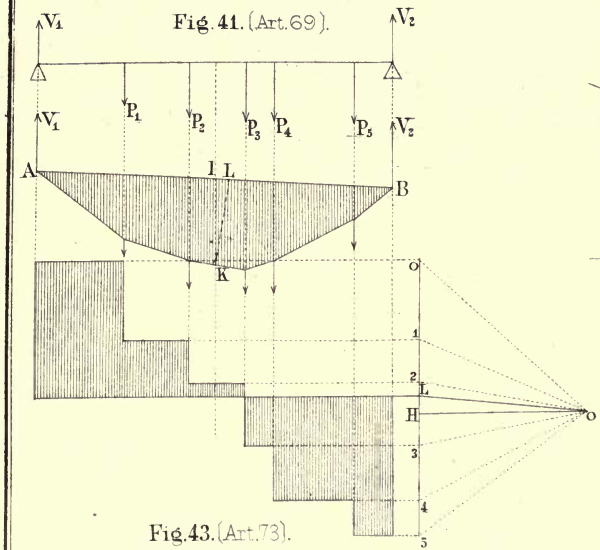


Fig. 41. (Art. 69).

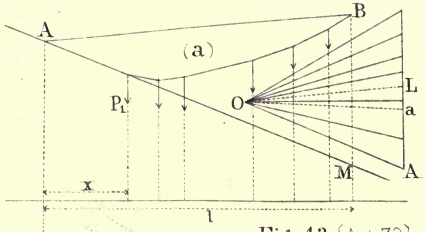


Fig 42. (Art. 72).

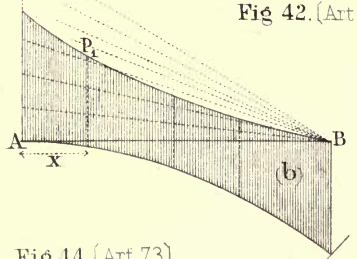
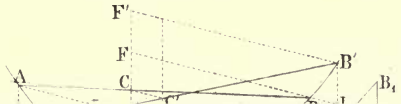
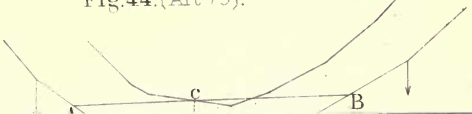
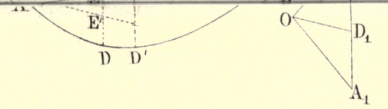


Fig. 43. (Art. 73).

Fig. 44. (Art 73).







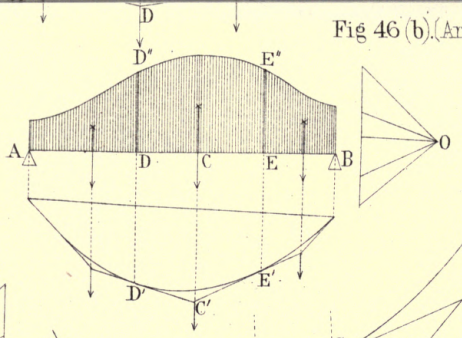
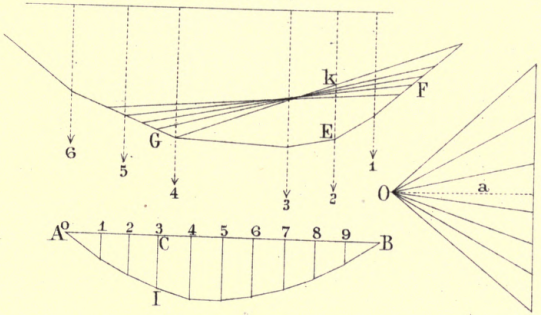


Fig 46 (b). (Art. 76).

Fig. 45. (Art. 74).



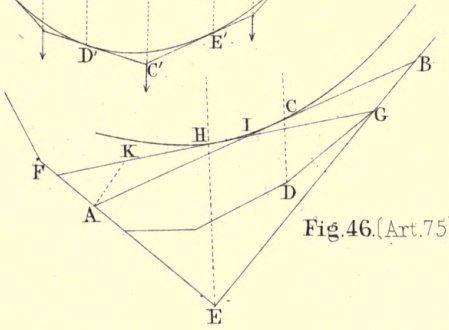


Fig. 46. (Art. 75).

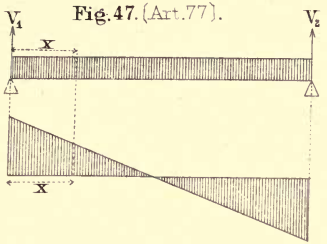


Fig. 47. (Art. 77).

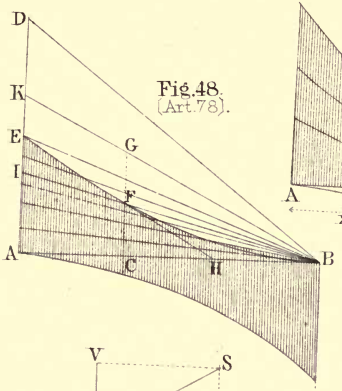


Fig. 48. (Art. 78).

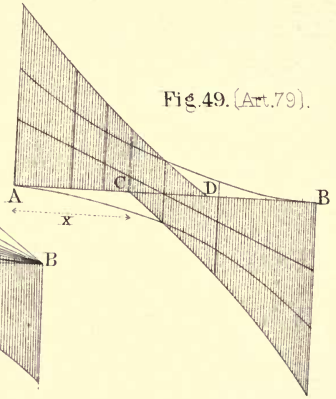


Fig. 49. (Art. 79).

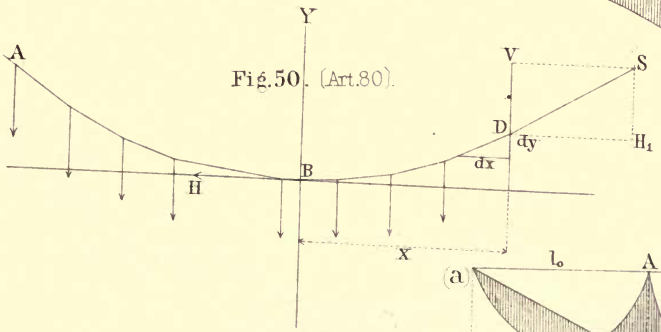


Fig. 50. (Art. 80).

Fig. 52. (Art. 82–87).

Fig. 51. (Art. 81).

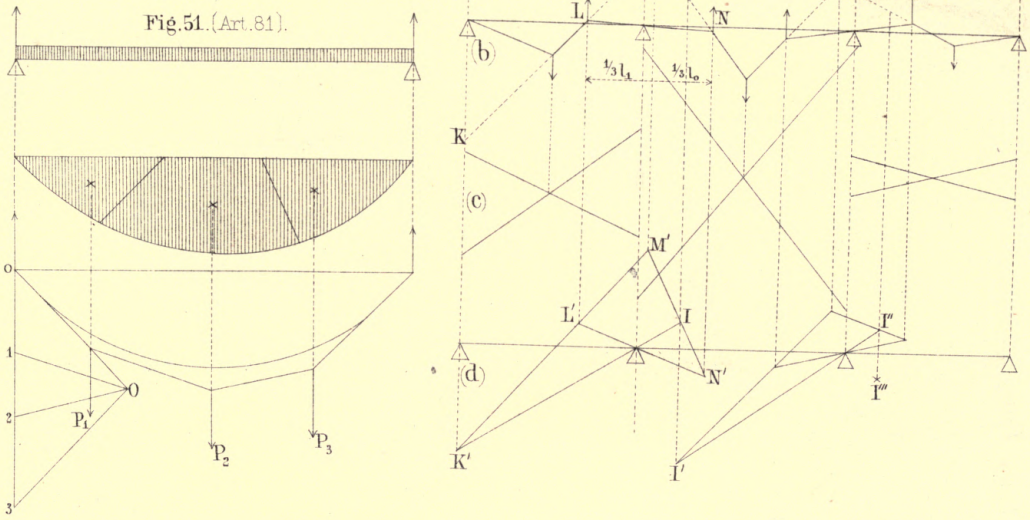


Fig.53. (Art.88).

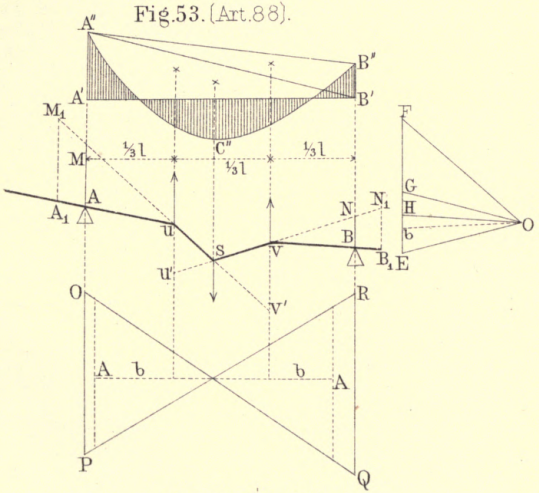


Fig.54. (Art.90).

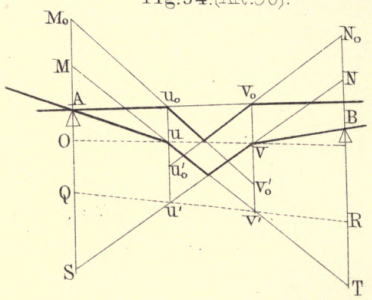


Fig.55. (Art.91).

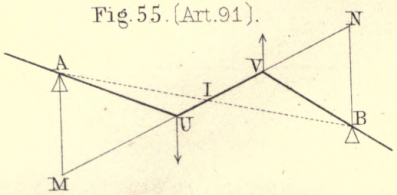


Fig.56. (Art.92).

Fig 57. (Art. 93).

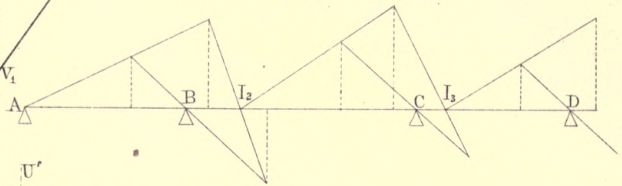


Fig. 58. (Art. 95).

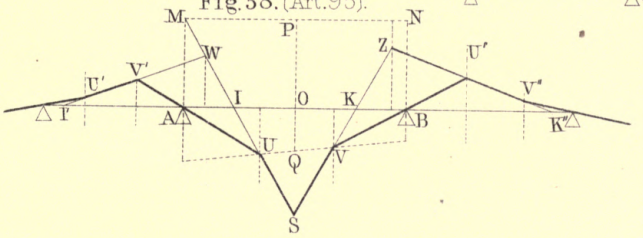


Fig. 59. (Art. 96).

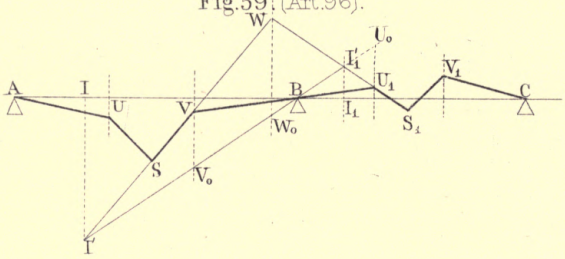


Fig.60. (Art.97).

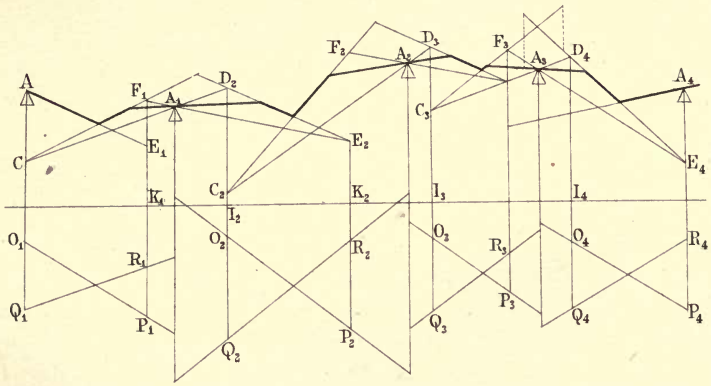


Fig.61. (Art.97).

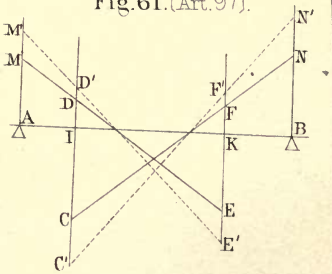


Fig.62. (Art.98).

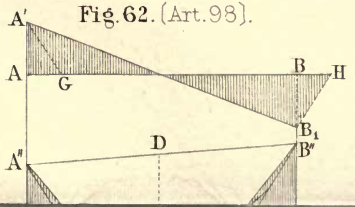
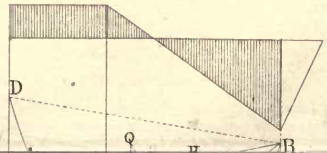


Fig.64. (Art.100).



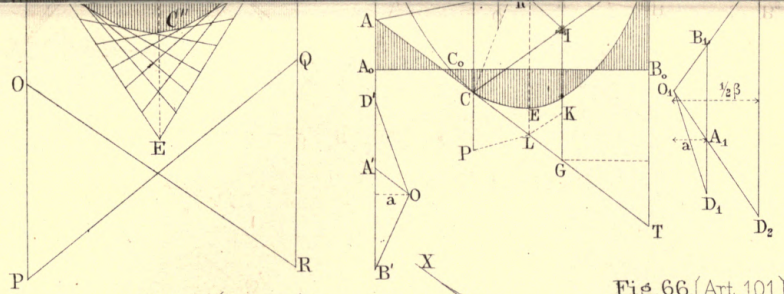


Fig. 65. (Art 101).

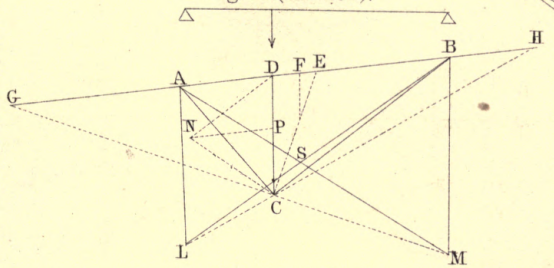
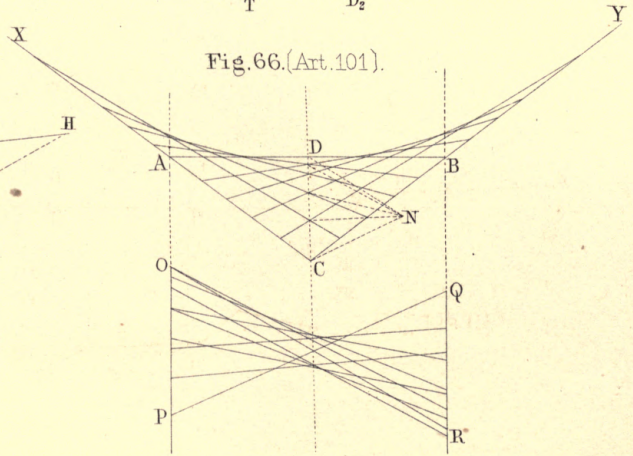


Fig. 66. (Art. 101).



Construction o

$l_1 : l :: 5 : 6$

$l_1 = 80$ feet. $l = 96$ ft.

$\frac{6}{11} \times \frac{1}{3}(l + l_1)$

l_1 l

$\frac{1}{3} l_1$

Scale of length = 50 feet to an inch.

Scale of force = 20 tons to an inch.

$p = \frac{1}{2}$ ton per ft.

Shearin

a a

Scale of Moments – 800 ft. tons to an inch

D Mo

D'

Second

Po

M' M_1

E' E

$\frac{1}{3} \frac{l}{l_1} l$

O

Cross Lines. (Art 98).

O' Q'

P' R'

P

xed Points. [Art. 93]

$l_1 = 1.6$ inches
$\lambda = l = 1.92'$
$\left(\frac{l_1}{l}\right)^3 = 0.6944$
$\left(\frac{l}{l_1}\right)^2 = 1.4400$
$\left(\frac{l_1}{l}\right)^4 = 0.4823$

Force.

$pl = 48$ tons $= 2.4$ in $= n$
$pl^2 = 4608$ ft. tons $= 4.608 = m$.

nts.

First pole distance

$a = \frac{2.4}{4.608} = \frac{n}{ml} = \frac{25}{48} l$
$a = 1$ inch.

ilibrium
on

Sec.d pole distance
$b = \frac{1}{6} l = 0.32$ inches

$OP = QR = \frac{1}{4} pl^2$
$O'P' = Q'R' = \frac{1}{4} pl^2 \left(\frac{l_1}{l}\right)^4$

Fig.67. (Art.102).

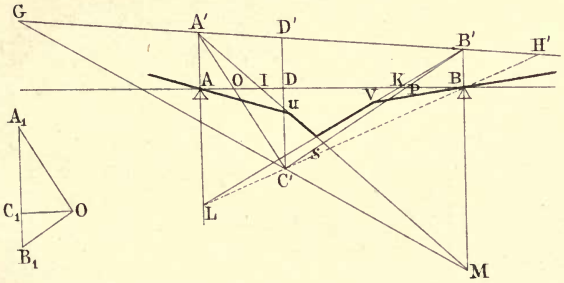


Fig.70. (Art.103).

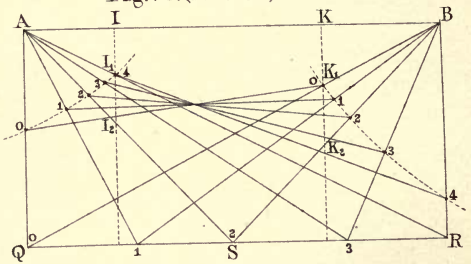


Fig. 68. (Art.102).

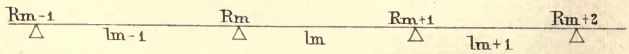


Fig.69. (Art.102).

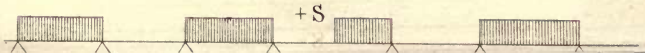
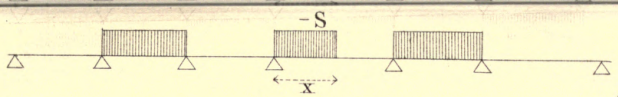


Fig.73. (Art.107).



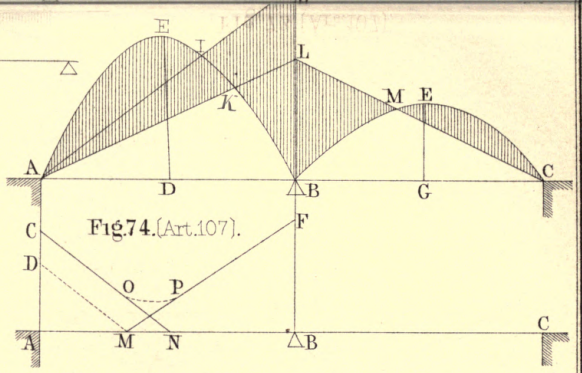


Fig.74.(Art.107).

Fig.75.(Art.107).

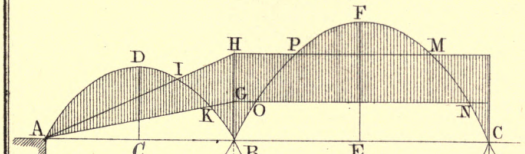
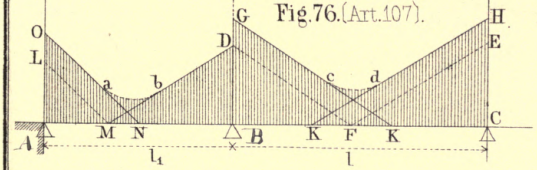
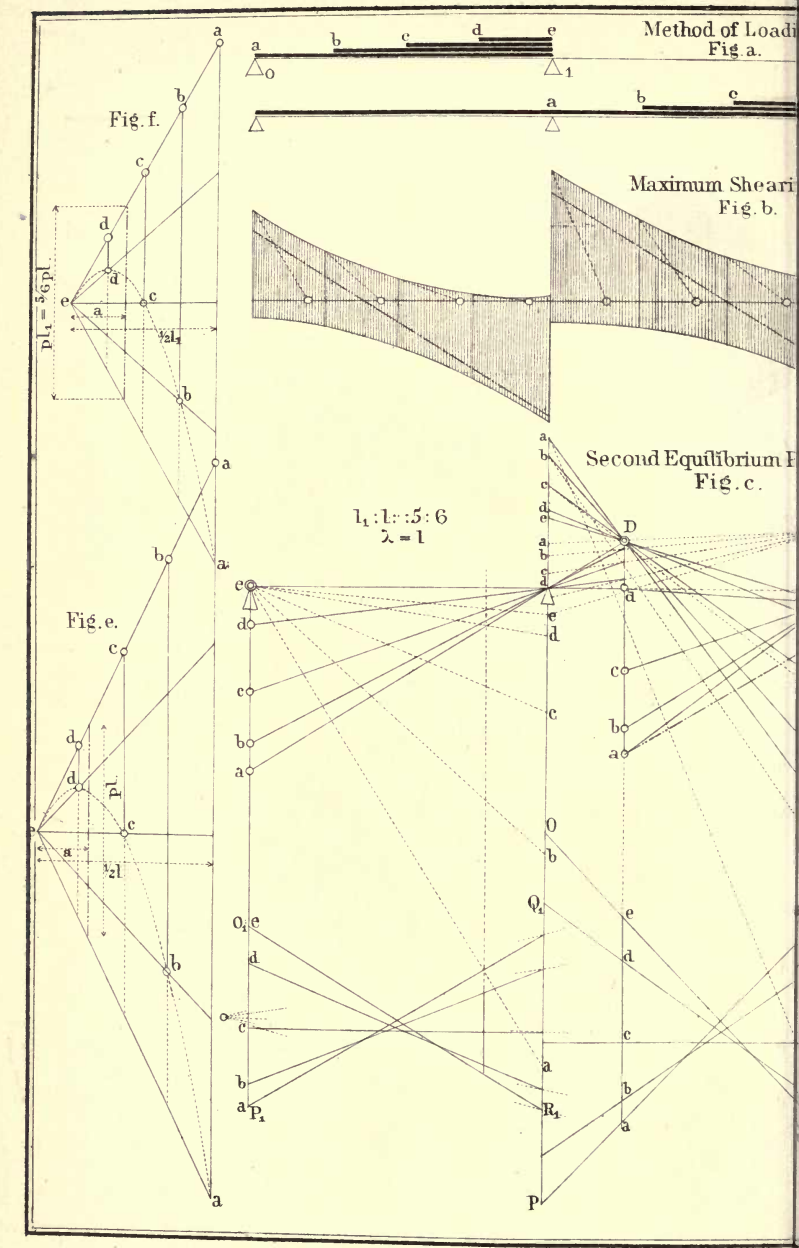


Fig.76.(Art.107).




Method of Loadi
Fig. a.
Maximum Sheari
Fig. b.
Second Equilibrium P
Fig. c.
Fig. e.
Fig. f.
$l_1 : l :: 5 : 6$
$\lambda = 1$
$pl_1 = 5/6\,pl$
$\frac{1}{2}l_1$
$\frac{1}{2}l$
pl
P_1
R_1
Q_1
O_1
P
D

ELEMENTS OF GRAPHICAL STATICS.

Fig 71.
(Art. 104.)

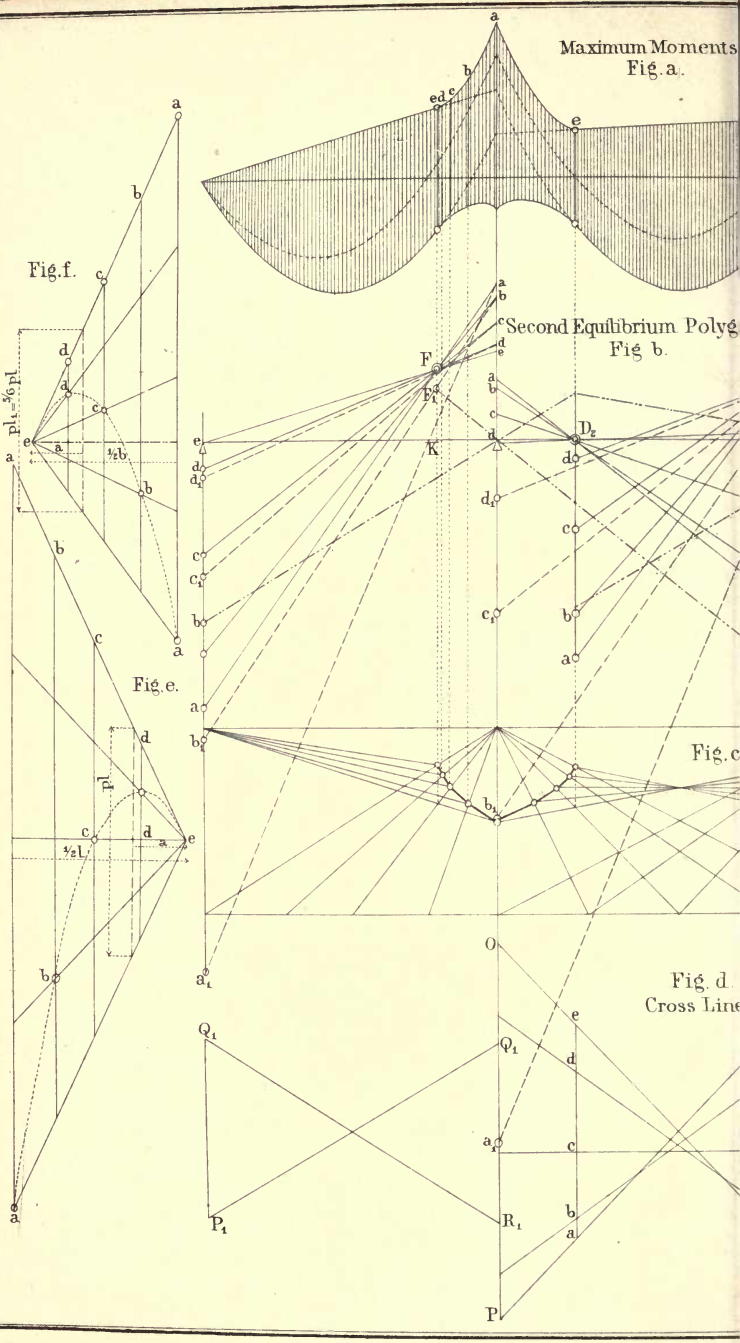
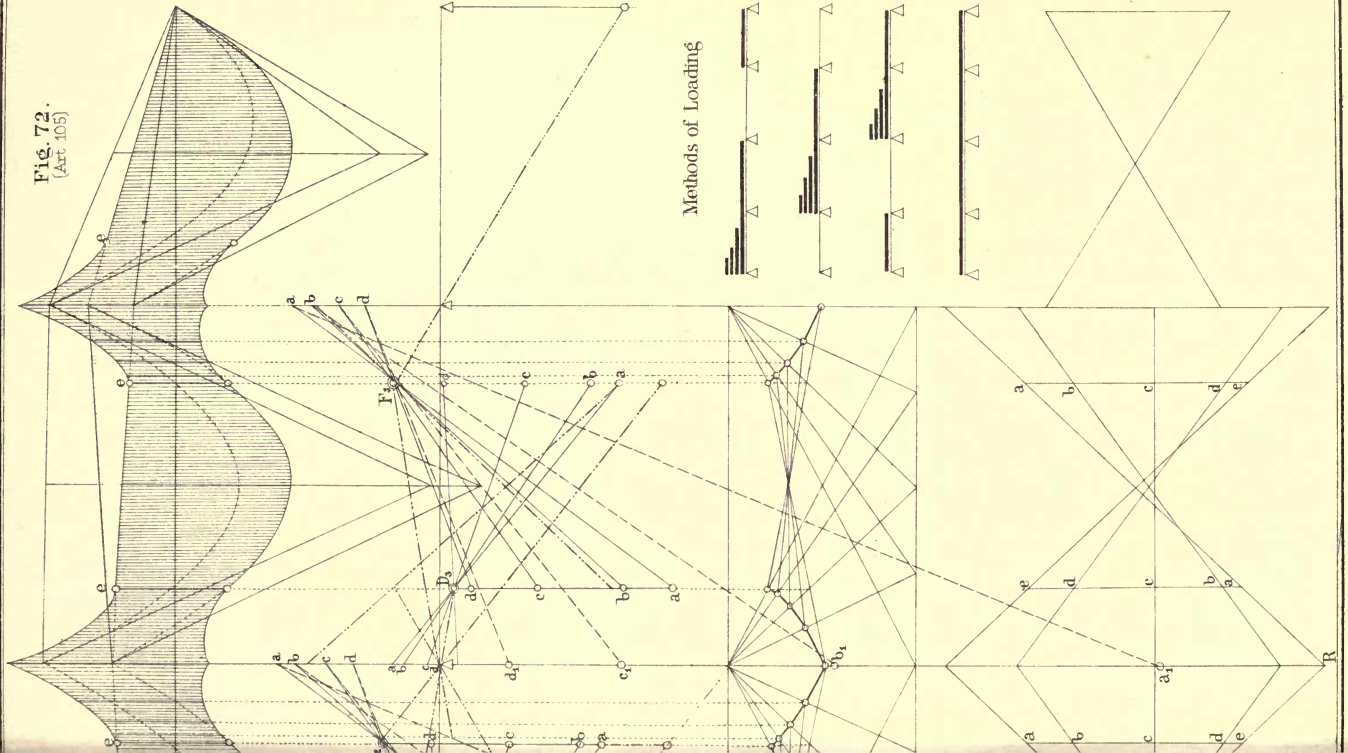

Maximum Moments
Fig. a.
Second Equilibrium Polyg
Fig b.
Fig. c
Fig. d
Cross Line
Fig. e.
Fig. f.
F
K
P
P1
Q1
R1
D2
½l
½b
a
b
c
d
e

Fig. 72.
(Art. 105)



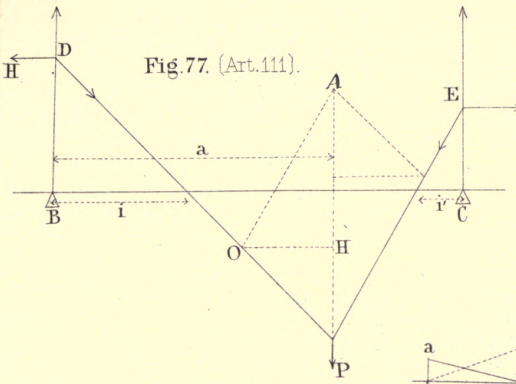
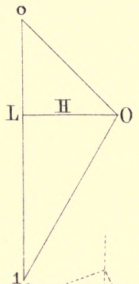


Fig.77. (Art.111).
H
D
A
E
H
a
B
i
i'
C
O
H
P


o
L
H
O
1
3

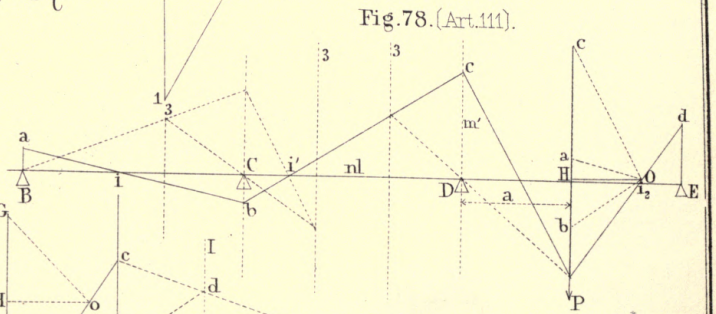


Fig.78. (Art.111).
3
3
c
c
m'
d
a
H
O
E
a
B
1
C
i'
nl
D
a
b
b
P

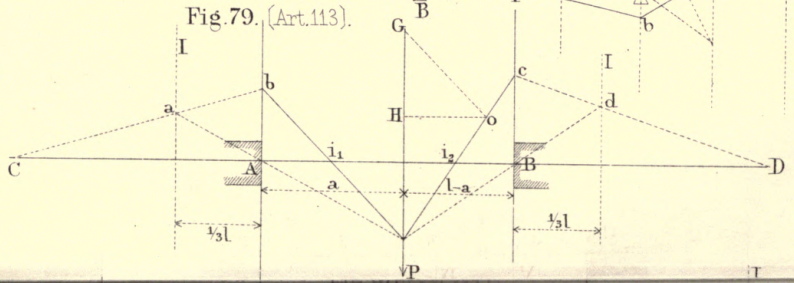
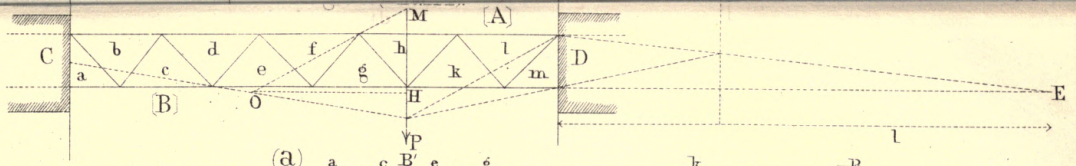


Fig.79. (Art.113).
I
G
I
b
c
a
H
o
d
C
A
B
D
i1
i2
a
l–a
⅓l
⅓l
P



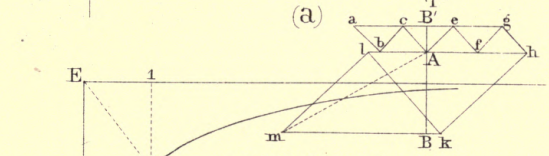
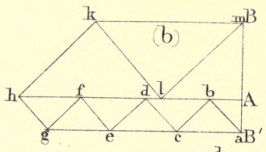
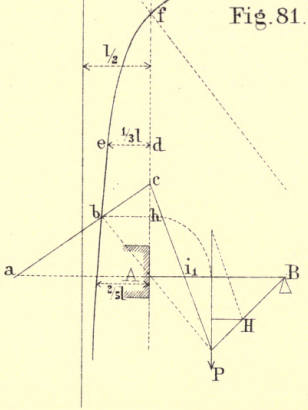


Fig. 81. (Art. 116).





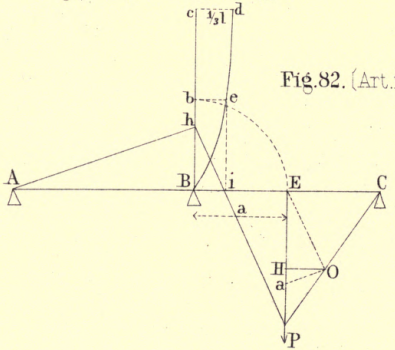


Fig. 82. (Art. 118).

Fig. 83. (Art. 120).

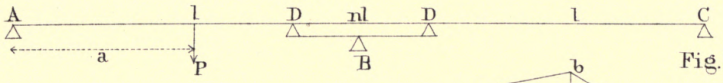


Fig. 84. (Art. 123).

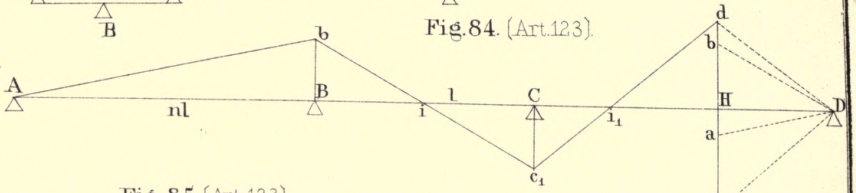


Fig. 85. (Art. 123).

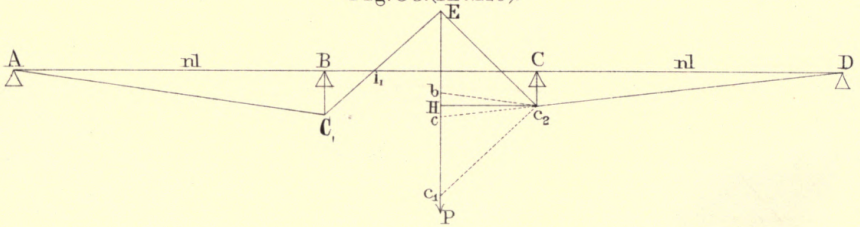


Fig. 86. (Art. 124).

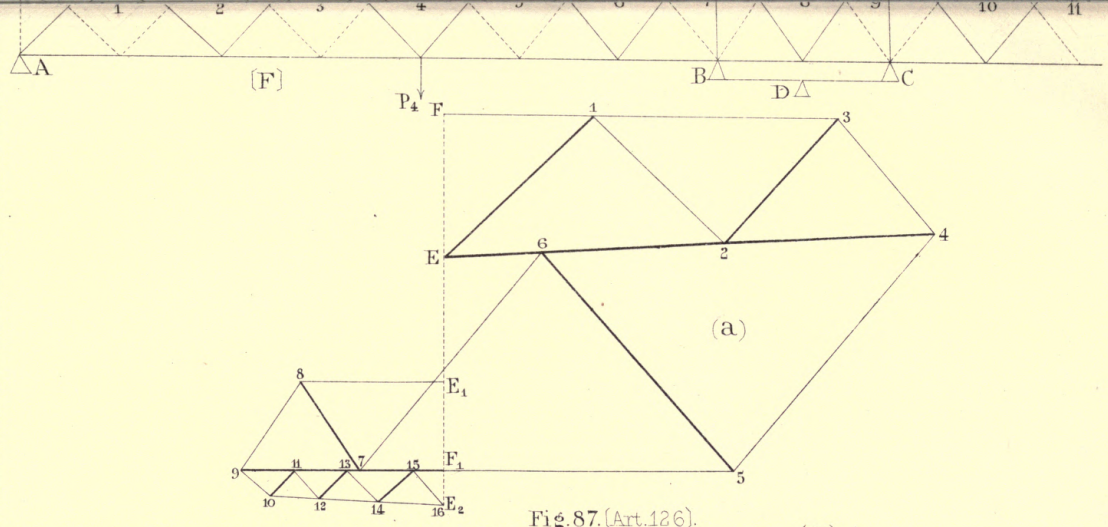


Fig. 87. (Art. 126).

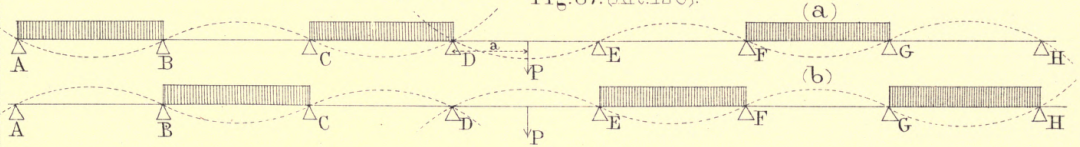


Fig.88.(Art.127).

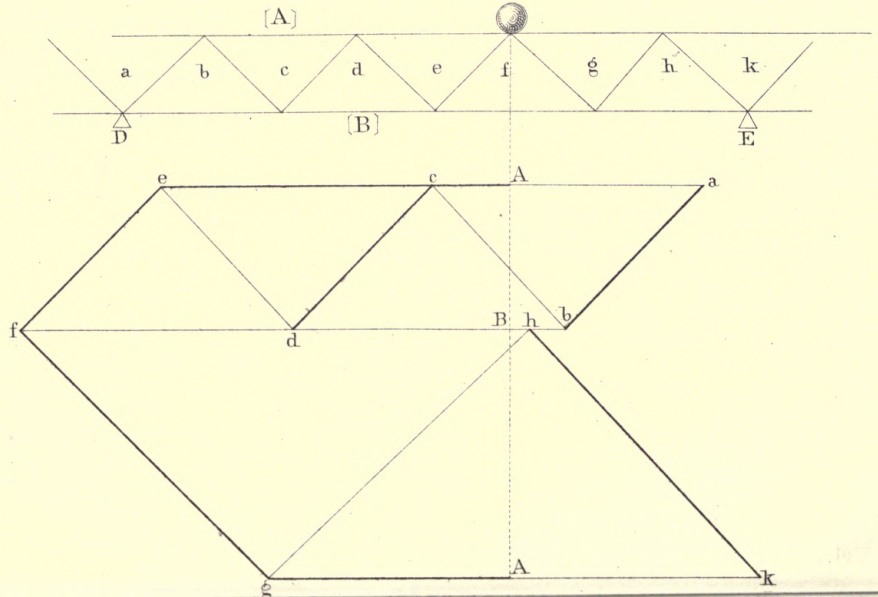
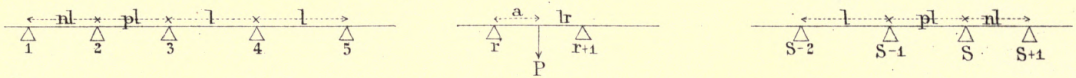


Fig.89.(Art.150).



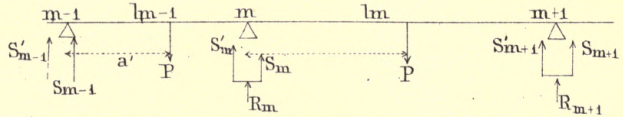


Fig.90.(Art.158).

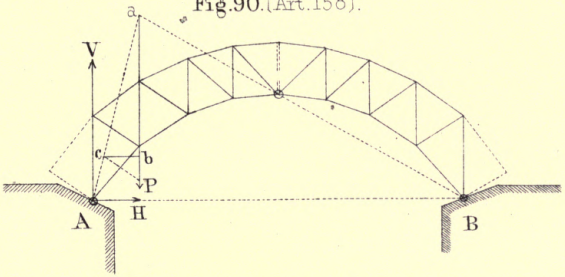


Fig.91.(Art.159).

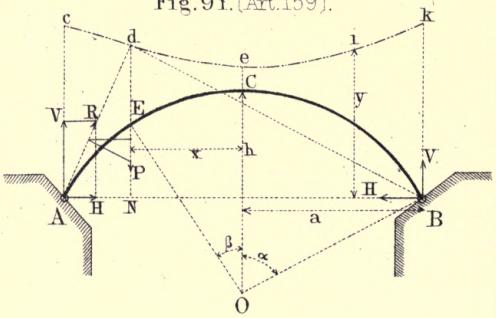


Fig. 92. (Art. 160).

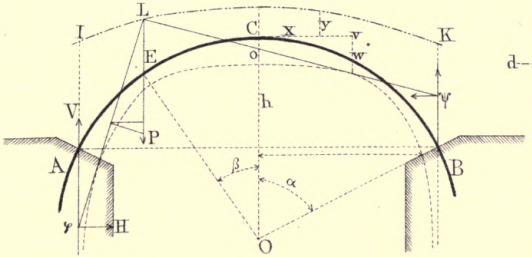


Fig. 93. (Art. 160).

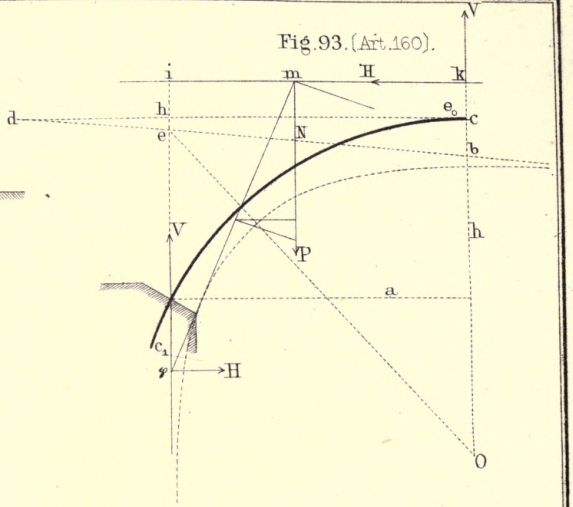


Fig. 94. (Art. 162).

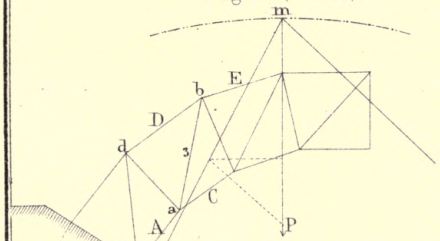
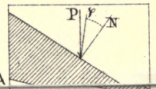


Fig. 96. (Art. 173).

Fig. 95. (Art. 169).



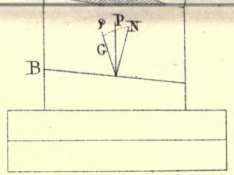


Fig.97. (Art.173).

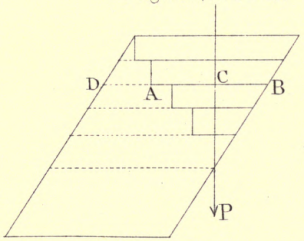


Fig.98. (Art.174).

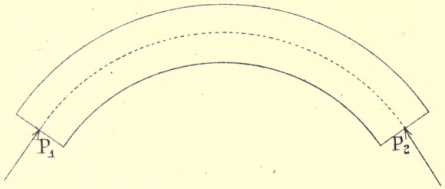
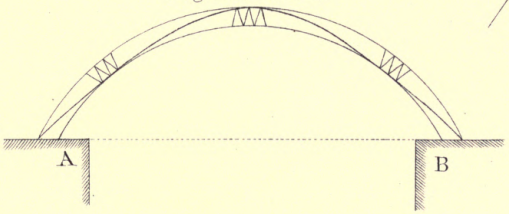


Fig.99. (Art.175).



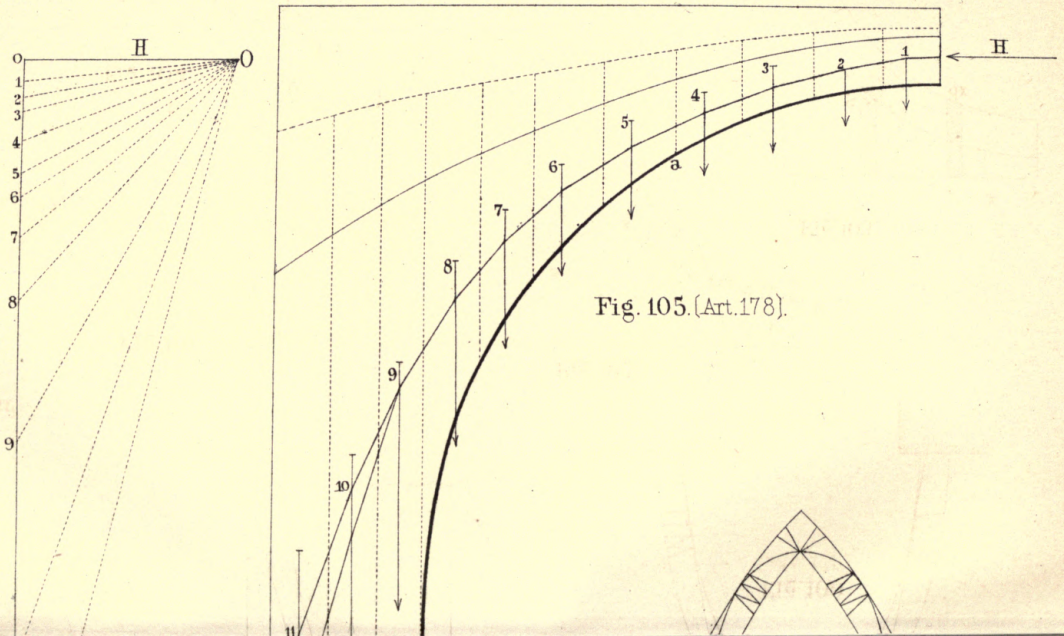
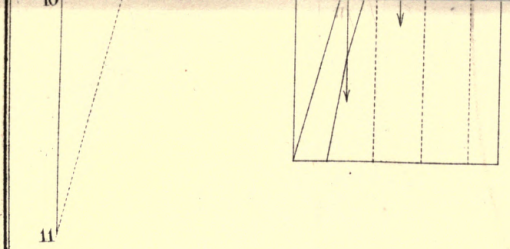


Fig. 105. (Art. 178).



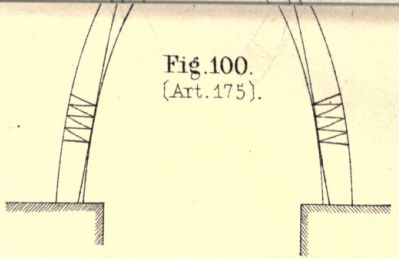
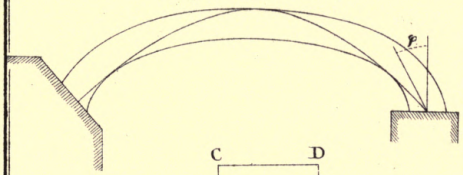


Fig.100.
(Art.175).

Fig.101.(Art.175).



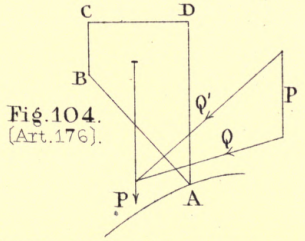


Fig.104.
(Art.176).

Fig.102.(Art.176).

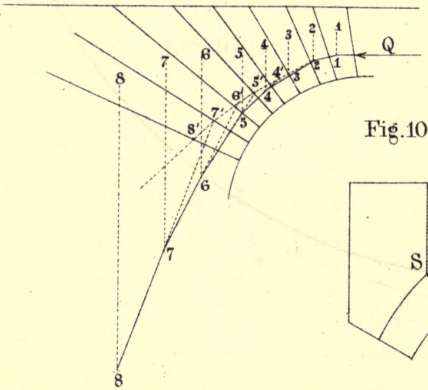
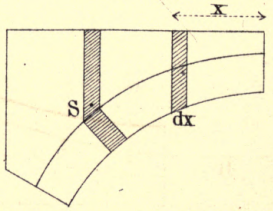


Fig.103.(Art.176).



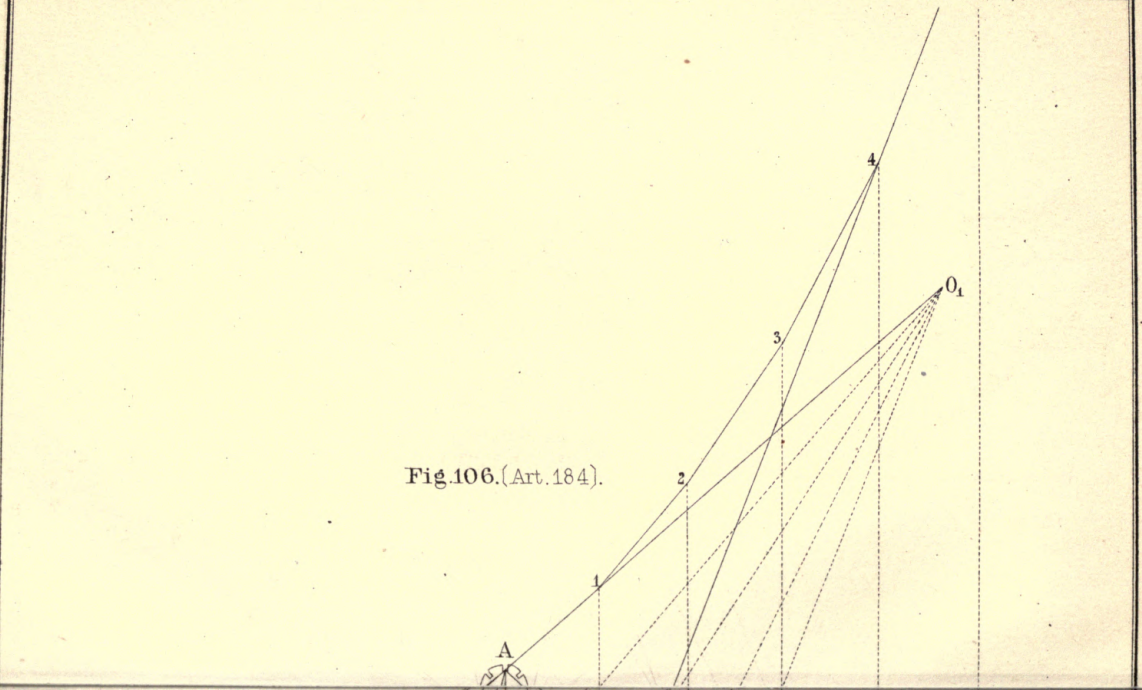


Fig. 106. (Art. 184).

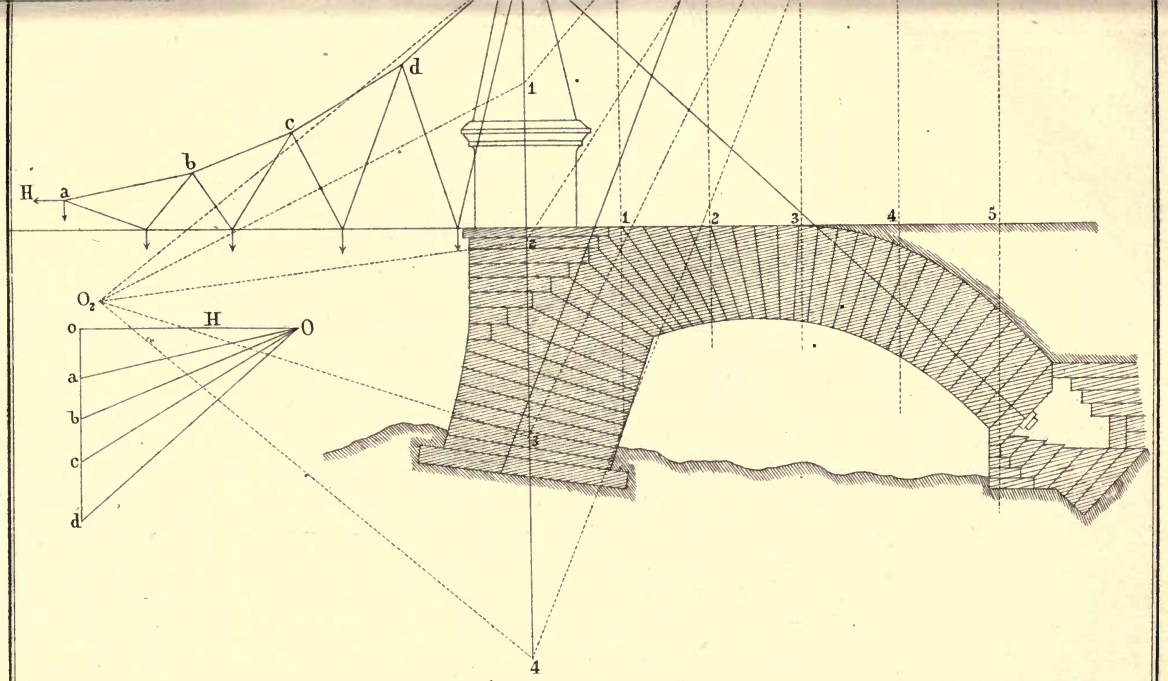

d
c
b
a
H
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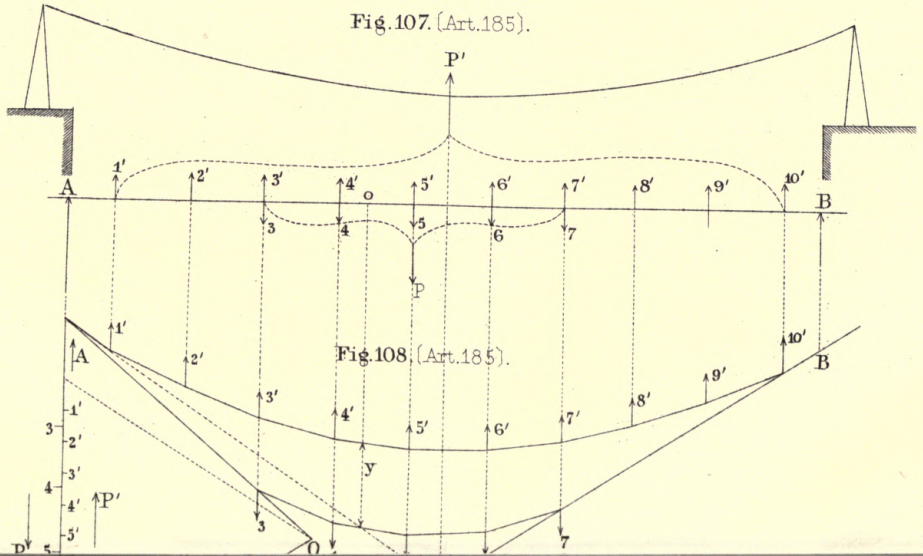
Fig. 107. (Art. 185).



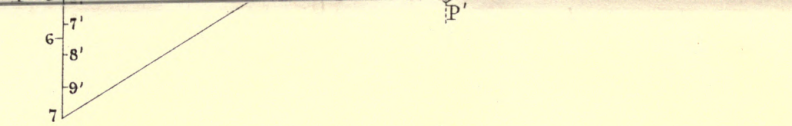


Fig. 109. (Art. 186).

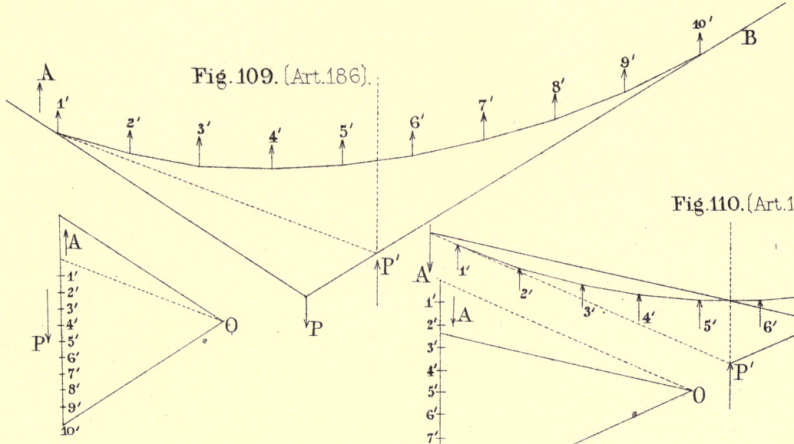


Fig. 110. (Art. 186).

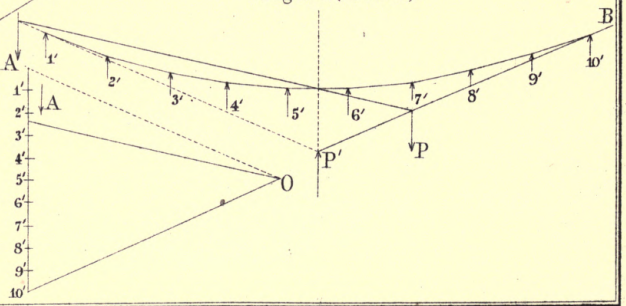
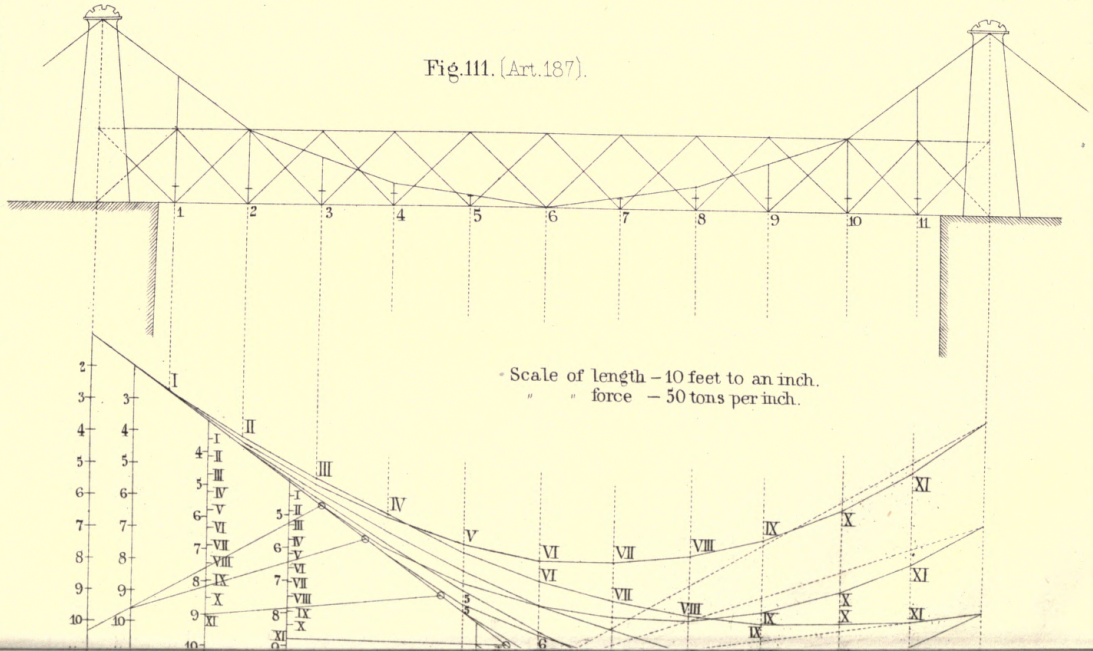
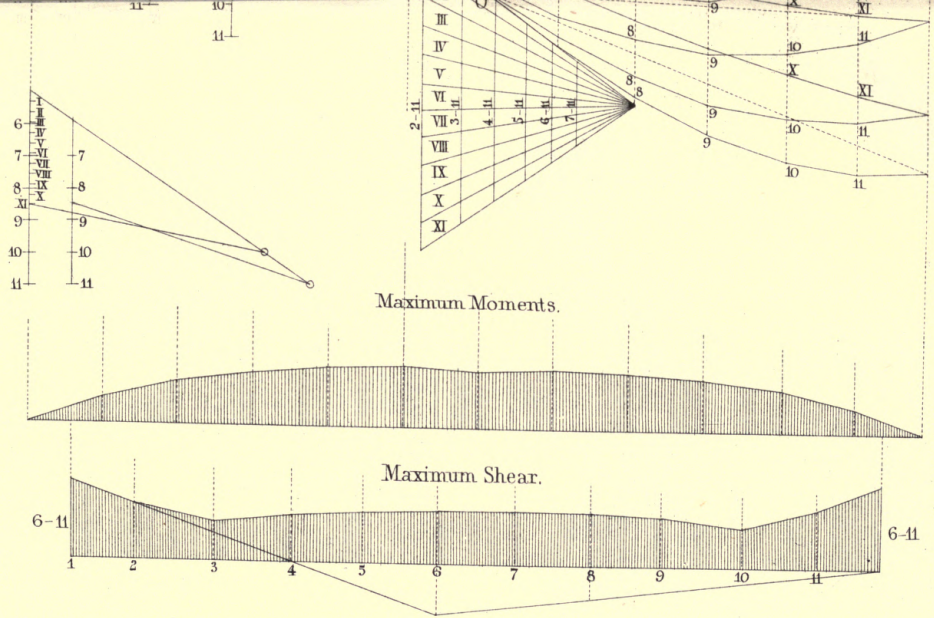


Fig. 111. (Art. 187).

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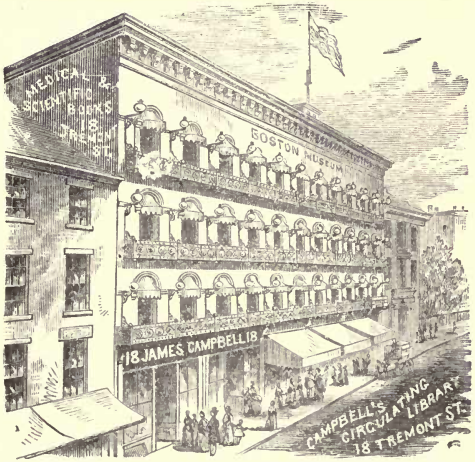

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